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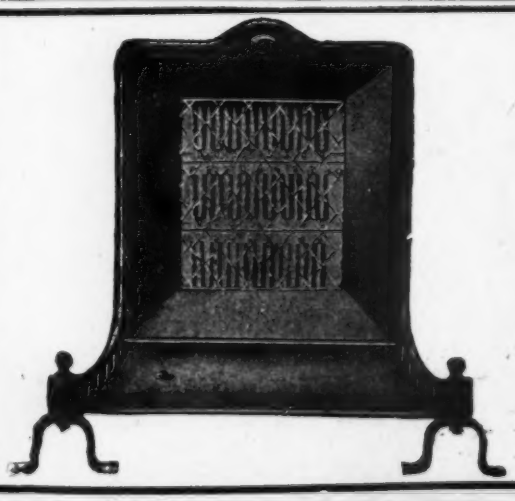

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"THE RIGHT TO WORK."

IT is sometimes stated that the unwillingness of some sections of Labour to work their hardest and increase production is due to their disinclination to increase the wealth of their employers. We can understand, though we do not say justify, that short-sighted attitude. What is less easy to understand, and cannot on any ground be justified, is the action of certain sections of Labour in preventing thousands of other workers from getting not increased wealth, but a living.

In the course of the House of Commons debate on Trade Unionism and unemployed demobilised men, it was stated that there were from 350,000 to 400,000 ex-service men now unemployed in the United Kingdom. The reasons for this are no doubt various, but one of the most deplorable is the obstruction which some Trade Unions place in the way of the training of these men. The engineering trades of the country were never busier, and there is plenty of work ahead, so that there is a capability of absorbing a great volume of additional labour—if suitably trained. In the case of the electrical industry, there is work in prospect for every man who is willing to do it—again, if suitably trained. Of the hundreds of thousands of fighting men who are now idle, a large number are understood to be young men who, while yet youths, were called away from their training to join the Forces and fight for a vital principle, and incidentally for the safety of those who stayed at home—included among their number being a goodly multitude of A.S.E. and E.T.U. men. The soldiers vacated places in industry which were to be awaiting them when they returned, and their training was to be resumed. What do they find to-day? The way to training is blocked—by Trade Union obstruction! and that, notwithstanding that many of them are disabled men, whose disabilities in the ordinary course should alone have evoked consideration. One may criticise a Union as a body without any direct personal application of the criticism, and without eliciting evidence of an individual conscience, but the members of Unions are individuals and have bodies if they have not souls. Who, then, are these men who are preventing their fellows from earning a living? Can it be that there are among them some who earned good money in safety at home while those whom they autocratically condemn to idleness were in the trenches and elsewhere amid all the terrors and horrors of bloody war? Who is the enemy now? The Huns are beaten—can it be that those who defeated them in the field now have to count their own kith and kin as enemies? While they were "over there" they provided them with munitions—now they will not let them earn their daily bread!

There must be some in the ranks of Unionism who have blushed for very shame because of this autocratic oppression. Trade Unionism has been the means of accomplishing great things that nothing else could have accomplished for industrial workers—the pity of it is that it is all put under a cloud of disgrace by the state of affairs which was revealed in the debate of last week. How can the most sympathetic and well-meaning writer refrain from saying hard things? Yet Labour, which uses hard words, is little likely to be moved by such. We might appeal to its reason, but that, we fear, would also fail. Will an appeal, based on the grounds of common humanity and of the inalienable right of every man to do work when there is work waiting to be done, meet with any greater measure of success?

The electrical and engineering labour organisations know well enough that the industries upon which their members depend give promise of great development and plenty of employment. We deplore along with the more humane sections of those organisations that in the House of Commons debate, these two trades had to be singled out for reference as leading obstructionists. For some time Trade Unionism, as we have latterly known it, has been on its trial. The jury—the general public—has been hearing the arguments and the evidence. Soon it will retire to consider its verdict. Happily not all Trade Unionism has been sinning in the matter under consideration, but there cannot be prodigals in any family without the whole sharing in the loss of prestige or reputation. Trade Unionism must cleanse and purify itself if it is to stand forth a useful and desirable part of the machinery of industrial life.

Pitiless, soulless, despicable, contemptible, and unclean thing is this attitude or plan which prevents fighters who have saved us in our hour of trial, from fitting themselves for settlement again in the ways of industrial peace and freedom. Who can recall the processions of years before the war, with banners waving, claiming "The Right to Work," without viewing with derision the present attempts to deprive one of that right?

The Labour Party repudiates the suggestion that the Trade Unions are callous or indifferent to the claims of the ex-Service men, calls it a "sheer misrepresentation," and describes the whole discussion as a Coalition publicity "stunt" against Labour. Yet it finds it desirable to suggest that the Trade Union Congress should arrange a joint conference between the several Trade Unions concerned and the various ex-Service men's organisations, to inquire into the whole matter, and prepare schemes for absorbing unused labour "without detriment" to "present industrial standards."

British Fairs and Overseas Trade.

Shortly after the war broke out, the Board of Trade organised some very useful exhibitions of German electrical and other goods for the guidance of British manufacturers. We counted it no small privilege to be able to contribute with our specialised information and knowledge to the preliminary work connected with this and other efforts made by Government departments. It was one out of many similar contributions that we made as a national duty toward the effort to ensure the availability of essential supplies for the purpose of the war, and toward the securing of the British trade position after the war. Government officials change, and Government Departments with them, and in reflective mood we sometimes revel in Thomas à Kempis's "testimony of a good conscience" while civil servants and others take the kudos. Much has happened since those early and important exhibitions were held. To-day we have firmly established amongst us the British Industries Fairs held under the auspices of the Board of Trade. The one that is now in full swing in three centres of the United Kingdom is a magnificent affair. Such parts of it as interest our readers we refer to on another page this week. The Birmingham Section is one of great value and importance. The Birmingham Corporation and the Birmingham Chamber of Commerce have, in collaboration with the Board of Trade, brought together a most businesslike collection of British manufactures, and the electrical and allied engineering trades have quite a large representation. At the Crystal Palace also there is quite a considerable proportion of exhibits of electrical apparatus. It is only right and proper that this should be so, and we believe that the firms which have taken advantage of this opportunity will reap due reward immediately if they wish to do so, and certainly later, when they require work more than they do at the moment. Buyers are here from the ends of the earth, and they will return to their different countries knowing far more of British ability than they knew when they came.

If firms refrain from exhibiting their wares or announcing themselves in these days, when all eyes are turned to these islands to see whether we are industrially alert, purely because they have more orders in hand than they can tackle—well, they will have *their* reward, and will deserve it. We congratulate the large number of firms which have adopted what we regard as the right policy by making this present effective demonstration in presence of the overseas buyer. Some of the exhibitors told us as we strolled down the chaotic gangways at Birmingham on Friday last, when the erection and setting out of stands was in progress:—"We have so much work to do that we did not *need* to exhibit, *but*—." We need not continue—the why and wherefore of the action of those busy people is so obvious to far-sighted men.

Lubrication.

To all users of machinery a precise understanding of the qualities of the lubricating oil used should be of the first importance. Whether it is so in fact, is often open to doubt. At any rate, the problem of providing suitable lubricating oil is more often than not left for the lubricating-oil manufacturer to solve, and it cannot but be said that first-class firms do provide a first-class article. That lubricating-oil manufacturers have their heart and soul in the business of improving their oils is seen in the recent important development which has been receiving the attention of some of the more scientific societies, such as the Physical Society and the Society of Chemical Industry, although there is also a considerable backing of practical experience.

It is commonly known to large users of lubricating oils that a pure mineral oil is of little value as a lubricant, and that the essential properties of "oiliness" are provided by mixing varying proportions of a fatty oil with the mineral oil, the percentage of fatty oil reaching up to as much as 20 per cent. For instance, one specification issued by a Government Department, for a lubricating oil for internal-combustion engines, stipulates 10 per cent. of lard oil to 90 per cent. of mineral oil. Another specification, for marine-engine bearing oils, is 80 per cent. mineral oil and 20 per cent. fatty oil, the latter being the general proportion for fast-running machinery under heavy loads. The novelty in the development in lubricating-oil blending to which we have referred is the use of from 0·2 to 2 per cent. of a fatty acid, instead of, say, 20 per cent. of a fatty oil, with the mineral oil, and practical experiments over 18 months, especially in large ships, have proved that a mineral oil with a fractional percentage of fatty acid is capable of doing the same work as an oil containing 20 per cent. of fatty oil.

The patent for this method of blending lubricating oils was applied for on February 5th, 1918, but owing to the war conditions, the publication of the patent was naturally prohibited; but the Admiralty carried out experiments, and the value of the process is testified to by Mr. Arnold Philip, the Admiralty chemist. These tests, and others, have shown conclusively that the substitution of this small percentage of fatty acid does reduce the frictional coefficient of bearings in the same degree, compared with a straight mineral oil, as, say, 20 per cent. of fatty oil. The question at the moment seems to be discussed mainly for the theoretical interest which the new process has in relation to the much discussed problem of "oiliness," but as to the practical result no doubt can be raised.

An interesting point is whether and to what extent this will reduce the cost of lubricating oils. Perhaps to the lubricant manufacturer there will be considerable savings in that he will have his fatty oils for other purposes, but upon the question of cheapening lubricating oils to the user, by the adoption of this new process, called the "Germ" process (for no very conclusive reason, by the way, because no germ enters into the process as might be inferred), nothing has been said. Nor have we yet been told whether the results are merely equivalent to the use of the very much larger percentage of fatty oils. A curious feature noticeable from the figures of tests is that up to 0·5 per cent. of fatty acid, there is a marked reduction of the frictional coefficient, but beyond that and up to 2 per cent., the further reduction is not so pronounced. In any case, this new development is one of considerable interest to all users of machinery.

A VISIT TO THE CHLORIDE ACCUMULATOR WORKS.

Now that accumulators are used to such a large extent for the propulsion of electric vehicles and industrial trucks, as well as for lighting, starting, and ignition purposes on petrol vehicles, much interest is being shown in their production. One of the most successful makes of accumulators on the market is that produced by the Chloride Electrical Storage Co., Ltd., at whose works at Clifton Junction, near Manchester, we spent a most interesting and instructive day last week.

When, seven years ago, there arose a demand for storage batteries for automobile starting, lighting, and ignition, this company, which was formed in 1889 and commenced operations in 1893, undertook to develop accumulators for this purpose. Extensive additions and alterations have recently been made to the works to enable them to cope with the heavy demand; the works, fig. 1, cover an area of 10 acres, employ over 600 workers, and to-day there are 1,110,000 "Exide" batteries giving satisfaction in motor-car service. In addition to manufacturing, this company is further serving its customers by maintaining an organisation which makes it easy for a car-owner to obtain a battery, or any help, information, renewals, or repairs, when such are necessary.

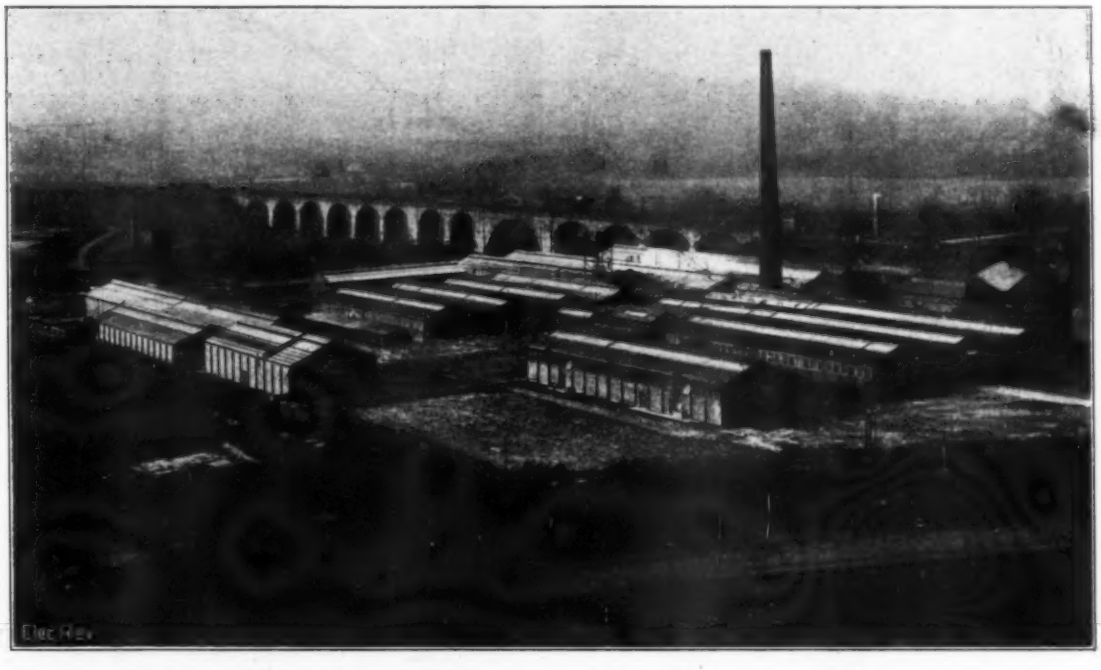


Fig. 1.—The Chloride Accumulator Works at Clifton Junction, near Manchester.

It is not always realised that an "Exide" auto-battery, which measures 12⅝ in. long., 7⅜ in. wide, by 9⅛ in. high, and weighs only 63·5 lb., can deliver over two million foot-pounds of energy, and that when cranking an engine it must often develop power at the rate of over 2 electrical H.P. Further, to be successful, it must do its work unfailingly, and at temperatures ranging from below zero to 100° F.

The positive and negative plates of these batteries are of the same general design as those used in the well-known vehicle batteries. A grid made of a stiff lead alloy (antimony) supports the active material in the form of a series of vertical strips held between the grid bars and locked in place by horizontal surface ribs, which are staggered on the opposite sides. After the grids are cast they are pasted with oxides of lead, made into a paste of special composition, which sets in drying like cement. Figs. 2 and 3 show the interiors of the plate-casting and moulding shops. The plates then go through an electrochemical process, which converts the material of the positives into brown peroxide of lead, and that of the negatives into grey spongy lead. Fig. 4 shows the forming shop where this process is carried out. Both the positive and negative plates are provided with an extension lug, and are so assembled that all the positive lugs come at one side of the jar, and all the negative lugs at the other, thus enabling each set to be burned together with a connecting strap, giving one positive and one negative pole. The burning is done by a hydrogen flame, and all the hydrogen and oxygen used in the works is generated on the premises.

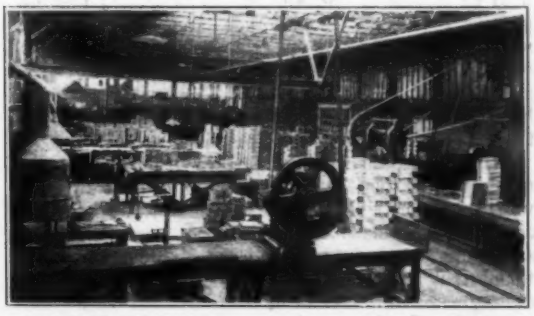
When the positive and negative groups are assembled, the adjoining plates are kept out of contact by means of wood separators ribbed on the side against the positive. The separators are made of tough wood, from which harmful substances are removed by a special treatment. It is found that when wood separators are used, about 10 per cent. greater capacity can be obtained than when glass rods are used. Further, an important point is that the wood absorbs the electrolyte, and therefore, even when the cell is inverted, the circuit is not broken; 50 per cent. of the normal output, or, in other words, the full discharge for half the time, can be obtained when in this position. This is a useful feature in certain cases, as, for instance, in miner's and other hand-lamps.

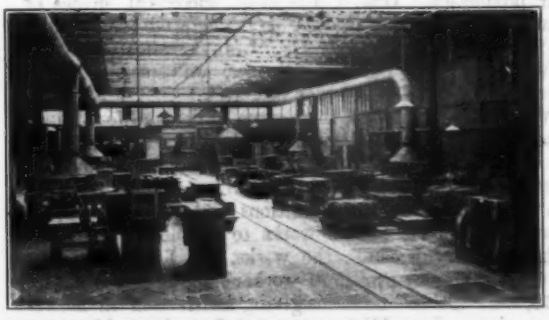
The cell container is a rubber jar of special composition, which will withstand vibration without breakage. The plates rest on stiff ribs in the bottom of the jar, fig. 6, allowing space for the accumulation of sediment. For railway train lighting batteries special glass boxes have proved to be superior to the old wood boxes lined with lead, which give trouble due to corrosion. With the glass box it is also possible to see what is going on inside without opening up the cell. Ebonite and celluloid boxes are also provided; in the former case nothing but pure water should be added to the electrolyte, but in the latter the acid should be changed about once a year.

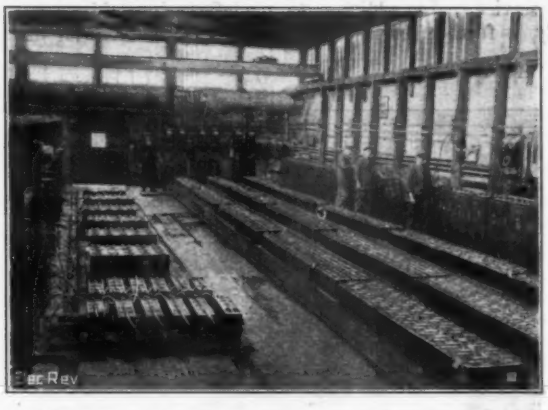
A special feature is the method of making a tight seal where the post goes through the cover (fig. 6). The strap post has an alloy collar which supports the jar cover, a soft rubber gasket being placed between. The post is threaded

where it comes through the cover, and the sealing nut clamps the cover tight, the rubber gasket making an effective seal.

From the illustrations (fig. 7) of the non-flooding vent and filling plug, it will be seen that it provides both a vented stopper (vents F, G, H) and an automatic device for







Figs. 2 and 3 (above).—Casting and Moulding Shops.

Figs. 4 and 5 (below).—Forming and Charging Shops.

the prevention of over-filling and flooding. In a simple and effective manner, the amount of water that can be put into the cells is limited to the exact amount needed to replace that lost by evaporation. This is accomplished by means of the hard rubber valve (A) within the battery cover and with which the tip of the filling plug (E) engages,

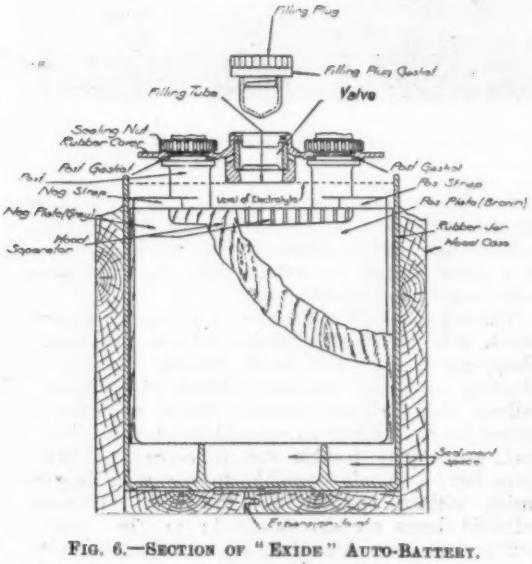


Fig. 6.—Section of "Exide" Auto-Battery.

as shown in the illustrations. The action of removing the plug (E) turns this valve (A), closing the air passage (B B), and forming an air-tight chamber (C) in the top of the cell. When water is poured in, it cannot rise in this air space (C) so as to fill the cell completely. As soon as the proper level is reached, the water rises in the filling tube (D) and gives a positive indication that sufficient water has been added. Should, however, the filling be continued, the excess will be pure water only, not acid. On replacing the plug (E), the valve (A) is automatically turned, opening the air passages (B B), and leaving the air chamber (C) available for the expansion of the solution, which occurs when the battery is working.

The works are electrically driven throughout; the total load on the generating station which is situated on the premises is about 4,000 amperes at 100 volts. Energy is

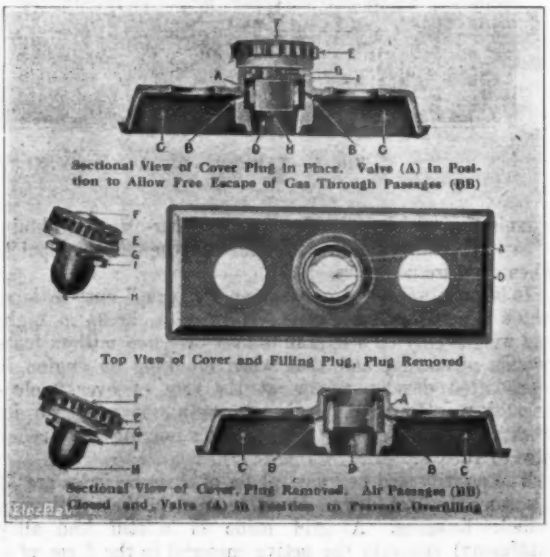

Sectional View of Cover Plug in Place. Valve (A) in Position to Allow Free Escape of Gas Through Passages (BB)
Top View of Cover and Filling Plug, Plug Removed
Sectional View of Cover, Plug Removed. Air Passages (BB) Closed and Valve (A) in Position to Prevent Overfilling

Fig. 7.—Non-Flooding Vent and Plug.

purchased from the public supply and converted; part is generated on the premises, but the steam plant is mainly regarded as a stand-by. A Mather & Platt automatic pump capable of dealing with 1,000 gallons of water per minute, and some 4,000 sprinklers distributed throughout the

works buildings, have been installed as a means of fighting fire. Adjacent to the battery charging shop (fig. 5) is a converter room equipped with a 66-kw. Phœnix motor generator, and the necessary switchgear for charging the completed accumulators. On the left of fig. 5 will be seen automobile batteries under charge, while on the right will be seen larger batteries as used in British submarines. It is of interest to note that during the war one firm alone was building submarines at the rate of one per month, all

Fig. 8.—Non-Spillable Accumulator.

Fig. 9.—Combination Hydrometer.

of which were equipped with Chloride batteries for underwater propulsion. These batteries weigh 150 tons each, and are composed of 332 cells, each weighing just under ½ ton. The firm has received an unsolicited testimonial from the Admiralty, testifying to the high quality of batteries supplied during the war period. The firm's entire output was absorbed by the Admiralty, and there has not been a single recorded case of a battery failing, although the conditions to be fulfilled were severe, the submarines being required to remain submerged for 24 hours at a time.

The cell illustrated in fig. 8 represents an advance in portable accumulator manufacture. The rigours of war service, especially on aeroplanes and for field telegraph purposes, demanded a cell from which no acid could escape in whatever position the cell was placed. The construction of the lid with the chambers attached, whilst allowing free exit for the gas, prevents the acid in any way exuding through the vent hole. This type of accumulator was adopted by the Ministry of Munitions after exhaustive tests, and many thousands were supplied for military, naval, and aero use during the war period.

For greater convenience a hydrometer syringe, fig. 9, has been produced, in which the hydrometer is placed inside a larger glass tube provided with a rubber bulb on the top and a suitable nozzle on the lower end. By squeezing the bulb, inserting the nozzle into the electrolyte and releasing the bulb, electrolyte is drawn up into the glass tube and floats the hydrometer. The reading is taken at the surface of the electrolyte, and when there is no compression on the bulb. Since electrolyte expands when heated, its specific gravity is affected by a change of temperature, *i.e.*, 0·001 for each three deg. rise or fall. Since the change of temperature does not alter the actual strength of the electrolyte, changing its density only, the gravity reading should be corrected one point for each three deg. change in temperature. For convenience 70° F. is considered as normal, from which point the corrections are made. For the convenience of the user, a thermometer has been designed with a special scale on which the amount of correction is indicated. This is on the opposite side of the mercury column and parallel to the temperature scale; that is, opposite to the temperature 70° is figure 0, showing that no correction is made at that temperature; three deg. below 70° is shown minus 1, indicating that the gravity should be corrected at that temperature by deducting one point; three deg. above 70° is shown plus 1, which indicates that the gravity at that temperature should be corrected by adding one point to the reading, as shown by the hydrometer.

Another handy device supplied by this firm is the carbon electrode holder for re-burning battery connectors. The advantage of the outfit lies in the fact that a spare 6-volt battery can be used as the source of supply for the operation, rendering unnecessary the use of further accessory apparatus, like the hydrogen generator.

In conclusion, we have to thank the Chloride Electrical Storage Co., Ltd., and the members of its staff, for the cordial manner in which we were received and shown over the works at the time of our visit.

A NEW THERMIONIC VACUUM TUBE.

By JOHN SCOTT-TAGGART.

The present writer evolved the type of vacuum tube described below at the works of the Edison Swan Electric Co., Ltd., while carrying out some experiments on grid control during September, 1919. As is well known, the usual modern three-electrode valve consists of a filament surrounded by a cylindrical anode, a helical grid being placed between filament and anode. A positive potential on the grid will produce an increase in the anode current, while a negative potential will produce a decrease.

The writer's valve is illustrated in fig. 1, p. 262. As will be seen, the form and relative positions of the electrodes are novel. The filament F is vertically arranged, the top support being a nickel-iron spring which keeps the filament taut when the latter is incandescent. The anode takes the form of a small metal plate placed preferably at a considerable distance from F. The control electrode, corresponding to the grid of an ordinary valve, takes the form of a metal plate G, preferably of larger dimensions than P and situated within a few millimetres of the filament F. The particular valve with which the curves, fig. 2, were taken possessed the following dimensions: plate P 10 mm. by 10 mm. by 0.008 in. nickel sheet; plate G 22 mm. by 10 mm. by 0.008 in. nickel sheet; filament F crimped, 25 mm. by 2.3 mils, tungsten; distance F to P 9 mm.; distance F to G 2 mm.

A series of characteristic curves are shown in fig. 2, and illustrate the effect of the control electrode potential on the anode current to P. It will be seen from the curves A, B, and C that the vacuum tube operates in a very similar manner to an ordinary three-electrode valve; that is to say, an increase of control potential causes an increase of anode current, while the reverse applies if the control potential is decreased. It will be noticed that the portions of the curves lying to the left of the ordinate through zero potential on the control electrode are very regular and similar to those obtained with an ordinary valve. The bends at the lower ends of the curves are present, as usual. When, however, the control electrode is made positive, we notice that the curves commence to lean over rapidly to the right. This is attributable to the fact that G is now drawing to itself a considerable portion of the electrons emitted from F. A milliammeter in the G circuit corroborates this assumption. This effect is far more marked than in the case of an ordinary valve, since the plate is more suitable for the absorption of electrons. The G current, however, does not build up immediately, but only becomes important when the G potential is higher than about +2 volts. We consequently see why the anode current curves of fig. 2 only commence to lean over

the right when the control potential passes +2 volts. To the right of the zero ordinate, the curves, it will be noticed, become less regular. When the control potentials reach higher values than those shown, the anode currents reach a saturation value, and then begin to decrease. This effect is shown in fig. 2 by the D curve, obtained by applying 75 volts to the anode and lessening the filament current from 0.7 amp. to 0.6 amp. The maximum anode current is reached at S. As the control electrode is given higher positive potentials, the anode current falls. Electrons which formerly went to the anode are now being drawn to the control electrode. It will be seen from the curves that an increase of anode potential displaces the anode current curve bodily to

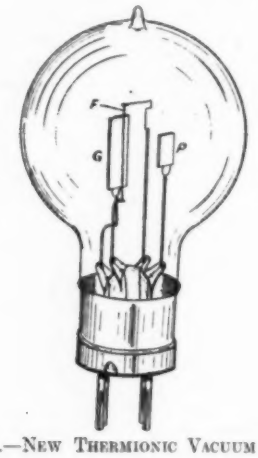


Fig. 1.—New Thermionic Vacuum Tube.

the left. In several other ways, the curves obey laws similar to those governing the characteristics of valves having grids placed between filament and anode.

It might at first be thought that the result of placing the control electrode behind the filament would be that an increase of control potential would partially neutralise the attraction of the anode, and so cause a decrease of anode current. This is what happens in the case of a valve described by Mr. J. Erskine-Murray, but the very opposite occurs in the writer's type of valve, which operates in the normal way. We may explain the action

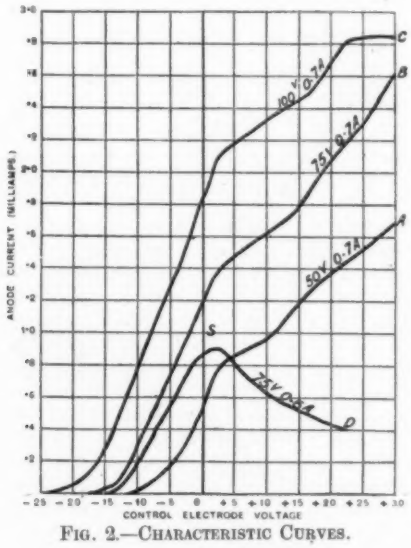


Fig. 2.—Characteristic Curves.

of the valve as follows: The filament F working at, say, 0.7 amp., is emitting a certain number of electrons per second. The anode P is capable of drawing to itself a certain proportion of these electrons. The remainder would be wasted, and would float around the filament and the inside of the bulb, especially behind the filament. These spare electrons would constitute a negative space-charge around the filament, and would tend to lessen the number of electrons passing to the anode. The effect now of applying a negative voltage to the control electrode G would be to repel many of the free electrons back into the neighbourhood of the filament, and so concentrate the space-charge; this in turn would lessen the anode current. When the control electrode is positive it will attract to itself most of the electrons constituting the space charge, and so cause an increase in the anode current. It is also certain that the electrostatic field of the control electrode extends itself on the other side of the filament, and this helps to explain the action of the valve.

A special condition is shown in the D curve. The anode current is now saturated, and practically all the electrons emitted from the filament are being drawn to the anode. By placing a positive potential on the control electrode an opposing attraction will be exerted on electrons actually on their way, or intending to proceed, to the anode. These electrons will be deflected to the control electrode, and the anode current will suffer in consequence. The anode current curve, therefore, falls, and it is to be noted that in this valve the anode current only decreases with an increase of control potential, when the latter potential is positive, and when the sum of the anode and control electrode currents is equal to the total emission from the filament. The same effect is obtainable with an ordinary valve, but the comparatively sharp bend at S is far more marked in the case of the writer's valve. This is easily explained by the fact that G is a large metal plate, far more capable of absorbing a large electron current than a very fine wire open helix.

Judging from the curves given, the amplification obtainable with this valve is not as high as in the case of the more usual pattern, although the actual results in a three-valve amplifier were almost as good. The representative point should preferably move only along the left-hand portion of the curve. The valve operates well as a detector, the point S being especially suitable for strong signals, both half oscillations producing a decrease of anode current. The vacuum tube also operates excellently as an oscillator and self-heterodyne receiver with 100 volts on the anode and 6 volts across the filament. No doubt, the characteristics and general properties of the valve could be greatly improved by further research on the sizes and relative positions of the electrodes.

COAL-PIT TO CONSUMER.

By "INTERESTED."

In the columns of the Electrical Review somewhere about the year 1910 I urged that riverside electricity works in particular, and other coal consumers situated alongside the river generally, should come to some arrangement as ship owners enabling them to purchase coal f.o.b. at the most convenient coalfield seaport, and to bring the fuel right up river alongside their own works without any further transhipping or handling. Had such a scheme come into operation about that time, or become a reality prior to the war—if only confined to the few electricity generating stations near or on the river bank—how many extra thousands of pounds would have been saved to those undertakings!

That period during the war, when shipping was being destroyed on a large scale week by week, was making—and eventually did make—the idea of coastal seaborne coal an impossibility owing to high freightage. Yet, during the whole of that period, one of our enterprising rivals calmly used his ship regularly carrying the precious fuel, thereby continuing in a higher degree that saving which was arranged for a few years earlier.

No doubt many readers will recall the s.s. *Wandle* coming up the river Thames after a smart and successful encounter with an enemy submarine. I could not sup-

press a smile some days afterwards when the newspaper report of that encounter reached me, giving an account of the voyage, and wondered if such publicity given in the daily Press, and the advertisement thus given to the idea of coal coming up under bridges without further unloading and barging, would then awaken that particular latent business bump in the minds of many riverside works managers. Perhaps not. Anyway, I put it to all interested that there is money in the idea, and the recent information given me that certain business men who are not directly concerned as coal consumers are seriously considering the advisability of purchasing a fleet of small steamers for the purpose of dealing with this scheme, serves to show that more than one man is alive to the possibilities. Why do not the actual coal consumers step in and become ship-owners, and thereby take all the profits?

Ships are at a premium—and never more worth that premium than at the present day. Good Welsh through and through coal can be purchased at the pit somewhere in the region of 27s. 6d. per ton, which, when the 4s. duty is added, makes the figure 31s. 6d. per ton, and by comparison with the prices ranging in London for delivery alongside by barge, or to the handy railway siding, the amount per ton out of which to effect a saving is the very considerable figure of about 12s. 6d. This, of course, refers to rail-borne coal. Current rates for sea-borne fuel put that manner of carriage at the moment out of the question.

Certain difficulties there are, I know, to be overcome; all the stronger reason for those difficulties to be promptly tackled and surmounted at once. Worse were taken in hand during the war, with excellent results.

The question of carrying coal from the pits to the situation of the works where actual consumption takes place is not one confined to the river Thames, but applies equally well to other parts of the country, and places around the coast. Railway charges are on the increase, and shipping rates likewise present a reflection of nothing but increase, notwithstanding the allowance of 10s. per ton off bunker coal. Ship-owners say we are paying because of high wages and demand. Owing to the ship shortage, which shows no sign of altering in the near future, high freights are secured for a long time to come. Obviously the procedure to enable consumers to effect a saving is to become their own carriers.

Considering these persistent and increasing high charges for carrying coal in conjunction with the large profits that are being made by shipping firms, is not this an appropriate time for large coal consumers whose works are favourably situated, and who at the present day pay harshly for cartage, seriously to consider if some arrangement can be made upon the lines here suggested for reducing their costs by taking a good proportion of the profits now going into the pockets of the ship and barge owners, and at the same time assisting to reduce the congestion of our railways, also thereby placing themselves in a position more or less free from the worry and trouble of strikes? This is a big question, and, I am sure, a profitable one.

The mass of material and goods daily barged up our rivers to premises alongside or near the banks leads one to consider whether this question of what might be termed small ship holdings would not prove a paying one to businesses other than large coal consumers, which, at the present time, are paying heavily for continual unloading from ships and reloading into lighters, and the consequent lighterage. At the time the bridge was built across the Thames at Kew, granite used in its construction came round the coast up river to the spot, without transhipment. That was a good piece of business, and if one such instance ensures a saving, why not others, especially to consistent users of barges?

THE BRITISH INDUSTRIES FAIR.

On Monday last this Fair, for which great preparations have been in progress for some time past, was opened in three sections, namely, in London at the Crystal Palace, at Birmingham (Castle Bromwich), and at Glasgow (the Kelvin Hall of Industries). The displays are on a large scale, and they are being visited by many thousands of visitors from overseas. The Fairs remain open until March 5th, so that readers who have not already made arrangements for attending whichever of the three they are specially interested in should do so at once. This week we must be content with giving a list of the electrical and allied firms who are exhibiting, with a word or two to indicate the general character of their exhibits. Fuller reference to matters of interest will appear in later issues.

LONDON.

The Fair which was opened at the Crystal Palace, London, on Monday, is by far the largest and most important of its kind that has yet been held, and, moreover, although the Palace is the largest exhibition building in the world, it has proved too small for the demands that have been made upon it; as long ago as last October only 80 per cent. of the applications could be granted, and applications have continued to come in daily ever since that date. The gangways of the Fair as organised measure 3½ miles in length, and the stand frontage amounts to no less than five miles. Admirable arrangements have been made for the comfort of the buyers and exhibitors, and special services of trains bring the Palace within 15 minutes of the City and West End. No fewer than 150,000 invitations to visit the London section of the Fair have been issued by the Board of Trade, of which one-third have been sent to firms abroad.

A perambulation of the show, which comprises well over 1,000 stands and 19 trades, subdivided into about 330 classes of exhibits, produces a deep impression on the mind of the visitor. The general excellence of finish of the wonderfully varied exhibits, the care with which the space available has been utilised to the utmost, and the businesslike arrangement of the individual stands, do the greatest credit to the official organisers and to the exhibitors alike; there is a marked difference between the Fair and an ordinary exhibition laid out to attract the public as well as the tradesman. The Palace is one gigantic shop, crammed with attractive wares laid out in most effective fashion, and if to deserve success is to command it, success is assured.

The exhibits of electrical interest do not bulk so largely in this section of the triple Fair as at Birmingham, but what there are, are very good. They are mainly associated with dry batteries and pocket lamps, electrical glass-ware and reflectors, small accessories, X-rays, telegraphs, clocks, and toys.

	Stand No.
Ball & Brockhurst, electric clocks	A90
Joseph Bourne & Son, Ltd., insulators and battery jars	C38
British Ever-Ready Co., Ltd., dry cells and batteries, pocket and hand lamps	R21
British Glass Wool Co., Ltd., glass wool	G14
Burtles, Tate, Ltd., glassware for lighting	F27
A. Chase & Co., Ltd., electrical novelties	B100
Clifford Bros., Ltd., electrical fittings, lampholders, switches	P9
Corgran Co., electrical toys	B101a
Dubilier Condenser Co., Ltd., electrical toys	P7

Stand No.

Edinburgh & Leith Flint Glass Co., electric lamp bulbs, &c. F7a
Doulton & Co., Ltd., porcelain and stoneware ... F12 & F31
Efandem Co., Ltd., dry batteries, lamp cases, and lamps R11
Gratham Manufacturing Co., electrical apparatus, telegraph keys, sounders, battery lighting sets, toys ... B12
Henry Harvey & Co., electric light reflectors P31
Hughes Label Co., Ltd., name plates and labels H40
Newton & Wright, Ltd., X-ray and electromedical apparatus E4
Orbit Electrical Co., Ltd., dry batteries A64
James Pitkin & Co., Ltd., electric chronographs, telegraphs, telegraph instruments, measuring instruments E1
Remoline Co., dry batteries, pocket lamps, toys A37
Rose Bros., dry batteries, electrical toys B21
Semaphore Engineering Co., Ltd., dry batteries, pocket lamps A39
Henry G. Richardson & Sons, glass electric fittings ... F26
Siemens Brothers & Co., Ltd., primary cells of all types, dry cells and batteries P3
Silent Electric Clock Co., Ltd., electric clocks and electrically controlled mechanisms for time indicating L73
The Sim, Ltd., electrical toys A115a
Vulco Manufacturing Co., accumulators, coils, &c. ... B107
John Walsh Walsh, lighting glassware and electric bulbs G25
Thos. Webb & Sons, Ltd., ornamental glassware, electric lamp bulbs F21
Wood Brothers Glass Co., Ltd., glassware, X-ray bulbs F10 & F13
A. C. Cossor, Ltd., incandescent electric lamps, X-ray tubes, wireless valves, vacuum pumps D1a
Marconi's Wireless Telegraph Co., Ltd., wireless telegraph apparatus, direction finders, detectors, valves, &c. F32

BIRMINGHAM.

From the electrical point of view, the show at Birmingham is the most important of the three. Castle Bromwich is only two stations out from New Street, and additional services of trains and motor 'buses run while the Fair is on. The aerodrome buildings adjoin the railway station. There are three buildings filled with exhibits, and the display is a thoroughly businesslike affair, a credit to the municipality and to the Birmingham Chamber of Commerce, who have taken the matter up so enthusiastically, and to the general manager, Mr. Charles Stanley. Those who have not time to visit all three cities will bear in mind that it is at Birmingham, and Birmingham alone, that they will be able to see the exhibits of electric lighting and heating manufactures, switches and switchgear, accumulators, vacuum cleaners, general hardware, tools, metal goods, motor accessories, weighing machines, and other goods of similar character. The greater number of electrical stands are in Building "A," and they will be found conveniently grouped at one end of the hall, or not far away therefrom. The catalogue is a finely prepared work, well worthy of the occasion, and it will doubtless be preserved by many colonial and foreign visitors for future reference.

The following firms are exhibiting in Building A :—

Premier Electric Heaters, Ltd., electric cooking and heating apparatus 1
Sun Electrical Co., Ltd., electric fires, heating and cooking apparatus, switchgear, lighting fittings, accessories, &c. 3
Bulpitt & Sons, Ltd., the "Better-Skeem" system of electric localised lighting, electric lighting fittings, lanterns, &c. 4
Chloride Electrical Storage Co., Ltd., storage batteries for use in country house lighting 15
Litholite Insulators, Ltd., moulded electrical insulators, electric lighting accessories 17
Donovan & Co., factory and domestic electrical apparatus, switchgear, motor starters, electrical accessories, lamps, bells, telephones, &c. A new departure in conduit switches is shown here 20
David Shanks & Co., Ltd., electric light fittings 21
Siemens Bros. & Co., Ltd., dry cells for all purposes, electric lamps, signs, electric light reflectors, electric irons, kettles, and radiators 22
Wm. Soutter & Sons, Ltd., electric light fittings ... 23
General Electric Co., Ltd., electric light fittings, switchgear, wires and cables, telephones, medical apparatus, vacuum cleaners, cooking and heating appliances, radiators, measuring instruments, &c. ... 24

Stand No.

Edison & Swan Electric Light Co., Ltd., electric light fittings and accessories, switchgear, wires and cables, conduit, bells, batteries, &c. 35
Sperryn & Co., Ltd., electric light fixtures and accessories 38
Chas. Joyner & Co., Ltd., electric light fittings, "Angelus" electric heating stoves 39
Ingram & Kemp, Ltd., electroliers and other electric light fittings 40
Player & Mitchell, Ltd., ships' electric light fittings ... 41
Benjamin Electric, Ltd., industrial lighting fittings, street lighting fittings, hand lamps, lighting accessories, battery horns for motor cars 42
Ward & Goldstone, Ltd., small generating sets and equipment for house lighting, electric wires, wiring system, &c. 43
Birmingham Guild, Ltd., electric light fittings 43a
J. H. Tucker & Co., Ltd., tumbler switches, and various electrical fittings and accessories, switchboards and switchgear 43
C. J. Thursfield & Co., Ltd., electric light fittings ... 46
Rex Import Co., Ltd., the "Rex Torrington" electric cleaner, electric clothes washers, electric hair brushes, &c. 47
J. Dugdill & Co., patent electric fittings 50
J. A. Crabtree & Co., Ltd., tumbler switches, and other accessories for electric lighting, heating, cooking, car ignition, &c. 50a
Best & Lloyd, Ltd., electric light fittings, electric heaters, &c. 51
Robinson & Hands Electrical Co., Ltd., fuseboards, lampholders, tumbler switches, &c. 53
Midland Electric Manufacturing Co., Ltd., Ironclad switches and switch and fuse gear 56
F. & C. Osler, Ltd., electric light fittings in metal and crystal glass 57
Etna Lighting & Heating Co., Ltd., electric lighting installation work for factories, country houses, &c. 58
Tok Manufacturing Co., Ltd., Tok rotary snap switches 92
Jackson Electric Stove Co., Ltd., various electric cooking and heating apparatus 63
Venner Time Switches, Ltd., automatic time switches 64
Improved Solidite Co., Ltd., substitute for ebonite, vulcanised fibre, porcelain, &c. 65
Semaphore Engineering Co., Ltd., dry batteries for various work, lighting sets for motor cycles, &c. 66
Austin Motor Co., Ltd., "Autoplant" electric generating plant 69
May & Padmore, Ltd., and Bastian Electric Heater Co., Bastian electric fire and heaters, electric furnaces, ovens, and flat irons, electrically heated water tanks ... ... 71 & 71a
Monometer Manufacturing Co. (1918), Ltd., melting furnaces, &c. 72
Jas. Hinks & Son, Ltd., lighting fittings 78
Samuel Heath & Sons, Ltd., electrical fittings and accessories 81
Burners, Ltd., electric light fittings, fire surrounds for electric radiators 86
Edgar A. J. Hooper, Ltd., electric light fittings 89
Berry's Electric, Ltd., "Magicoal" electric fires ... 102
Thomas R. Carpenter, Ltd., electric light fittings ... 104
Falkirk Iron Co., Ltd., electric heating and cooking apparatus 124
Burt, Escaré & Dennelle, Ltd., electric light fittings ... 134
Daisy Vacuum Cleaner Co., Ltd., electric vacuum cleaners 150
Birmingham Private Telephone (New System) Co., Ltd., automatic intercommunication telephones and other telephone apparatus... 151
Electric Appliances Co., Ltd., vacuum cleaners 157
Federation of British Industries (Information Bureau) 163
Thermal Syndicate, Ltd., "Vitreosil" specialities for electric lighting, lamp shades 164
Peyton & Peyton, Ltd. (and others), electric light fittings 168
J. G. Cracknell & Co., electric vacuum cleaners 171
Watertight Fittings, Ltd., electric lamp fittings 174
Changeable Sign Co., Ltd., illuminated electric signs ... 182a

Exhibitors in Building B :—

Henry Wiggin & Co., Ltd., electrical resistance wire and tapes, nickel 185
Vickers, Ltd., Cosmos electric lamps, electric irons, kettles, radiators, wires and cables, engineers' small tools, sewing machines, &c. ... ... 206 to 211
A large number of firms are showing drop forgings for electrical, automobile, aircraft, and other work, and the Association of Drop Forgers and Stampers is represented ... ... 212 to 236
London Electric Wire Co. & Smiths, Ltd., wires and cables for electrical apparatus 237
Electrical Conduits, Ltd., tubes and fittings for electrical installation work in buildings, ships, &c. 238
The Cold Rolled Brass and Copper Association, the Brass Wire Association, the Brazed Brass Tube Association, the Brass and Copper Tube Association, and the Nickel Silver Association ... ... 242 to 247

	Stand No.
Thos. Bolton & Sons, Ltd., brass rods and wire, phosphor bronze wire, &c.	258
Chas. Clifford & Son, Ltd., brass rods and wire, &c. ... (And many other brass and copper firms.)	261
W. & T. Avery, Ltd., weighbridges and weighing machines	352
H. C. Slingsby, trucks, ladders, &c.	355
Stewarts & Lloyds, Ltd., steel piping, tramway poles, boiler tubes, &c.	358
Hunt & Mitton, steam fittings	360
Gledhill-Brook Time Recorders, Ltd., time recorders ...	364
National Time Recorder Co., Ltd., time recorders ...	378
British Time Recorder Co., Ltd., time recorders	382
Relay Automatic Telephone Co., Ltd., relay automatic telephone system	383
Simoon Engineering Co., Ltd., D.C. electric motors, motor generators, ironclad switchgear	384
Vislok, Ltd., safety locknut	389
British Engineers' Association	406
Alloy Welding Processes, Ltd., A.W.P. electric arc welding plant	407
Consolidated Pneumatic Tool Co., Ltd., electric drills and other tools	420

Exhibitors in Building U:—

Association of British Driving Chain Manufacturers ...	461
May & Padmore, Ltd., Bastian electric fire and heaters, electric furnaces, electrically heated water tanks ...	468
Best & Lloyd, Ltd., electric fittings and heaters	477
W. Canning & Co., dynamos for electro-plating, &c. ...	485
Vacuum Oil Co., Ltd., lubricants	493
Industrial Appliances, Ltd., "Railodok" electric truck	503
Western Electric Co., Ltd., Electric trucks, telephones, and telephone switchboards	511
British Ever-Ready Co., Ltd., electric cycle lamps and electric motor car accessories	525
Sphinx Manufacturing Co., sparking plugs with bar-type electrodes	527
Lucas Electrical Co., Ltd., Thomson-Bennett magnetos, Lucas "Magdyno" combined lighting and ignition set for motor cycles	530
Greenwood & Batley, "Bipol" accumulators, portable electric lighting apparatus, charging equipment ...	533
British Lighting & Ignition Co., Ltd., "Blic" magnetos	546
Pinchin, Johnson & Co., Ltd., enamels, varnishes, &c.	564 & 571
Frederick Crane Chemical Co., Ltd., lacquers for electric lamps, varnishes, enamels, &c.	569

GLASGOW.

The Glasgow Fair has been organised by the Corporation with the support of the Board of Trade. This is Glasgow's third Fair and the largest it has yet held. There are about 300 exhibitors in all, and they demonstrate British ability in the production of textiles, boots and shoes, dyes, chemicals and foodstuffs. In addition there are various miscellaneous stands, such as labour-saving machinery, transport trucks, and so forth. Mr. J. M. Freer is the general manager at Glasgow.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Electrolytic Meters.

An article written by Mr. C. W. Marshall on "Meters" published in the Electrical Review, February 6th, has caused some comment on electrolytic meters. May I venture to express my views?

First, no meter reader should be an authorised person to break the test room seal and so expose the interior of a meter. In the case of resetting an electrolytic meter this has to be done, and as the record of the reading is lost only an inspector should carry out this operation.

Second, should any dispute arise concerning the reading after a meter has been reset, it cannot be checked.

Third, if these meters are not reset with very great care they are liable to stop, due to the column of mercury breaking.

Fourth, there is the liability of loss of revenue due to the mercury rising above the reading on the dial when not reset in time.

Although the makers have improved very much upon the earlier types, they have not yet overcome the trouble arising from crystallisation and electrolysis, and the result is an accumulation of defective meters, and consequently loss of capital.

Owing to the meters being unrepairable in the department they have to be sent to the makers, and commenting upon this, I have found it much easier to get new meters, as for some reason or other they are very reluctant to undertake the repairing, and also the cost of repairs approaches very near the price of a new meter.

The electrolytic meter is affected by vibration and dampness, and also takes up more room, due to a space having to be left over the meter to allow for resetting.

In refixing, the man is unable to report if the meter is working, and this entails another visit two or three days later.

Compared with the "rotary" meter, the life is not so long, and extra time is taken up in resetting and writing to consumers who have queried their readings.

Another point in favour of the rotary type beyond their reliability is the fact that readings can always be checked.

A. W. C.

February 18th, 1920.

With further reference to the controversy Electrolytic *v.* Motor Meters, I did not mean to imply that the electrolytic meter was as extensively used as the motor meter, but merely to point out that the former type may by no means be ignored in the search for a cheap meter, which was the basis of Mr. Marshall's article.

As regards price competition, the price given by Mr. Marshall for a mercury meter (which he suggests as the coming cheap meter) is £4 10s., whereas the price of the corresponding electrolytic meter is about £2. I am quoting the Reason meter, which does not require refilling and therefore does not demand any allowance on the initial price for maintenance (filling) charges. Having the above prices in view, I am still of the opinion that, even eliminating compensating devices, &c., the mercury motor meter manufacturer will have a big problem to reduce his prices to less than half the present prices, and even then I do not admit that the electrolytic meter cannot be still further developed and cheapened.

With regard to size, I specified "lighting demand," and not heating, &c. It is usual to charge a reduced price for heating and cooking, and this necessitates a separate meter, which may be much rougher than the lighting meter, seeing that low starting current is not an essential.

In conclusion, it would be interesting to have the suggestions for a cheap meter which Mr. Marshall promises in the last paragraph of his article.

H. W. M.

February 23rd, 1920.

With regard to Mr. C. W. Marshall's recent article in your Journal, while we are not able at present to supply any type of electricity meters at a price as low as £2, we certainly can quote figures that are very much more favourable than those which Mr. Marshall suggests as being the present-day approximate costs.

Moreover, we have available a D.C. mercury motor meter which we are able to supply at quite attractive prices, and whose watt loss does not exceed that allowed by the British Engineering Standards Specification No. 37, 1919.

We shall be very happy to give Mr. Marshall or indeed any other potential client further details on receipt of an inquiry.

For the **Edison Swan Electric Co., Ltd.,**
E. H. Miller, *Sales Manager,*
Ponder's End, *Inst. & Meter Dept.*
February 19th, 1920.

Radiators for Bathrooms.

There is a demand for a good radiator suitable for use in a small bathroom. This should be made with a non-metallic body, while the elements should be protected so that they will not be liable to be damaged by drops of water falling on them. The switches also should be made with special regard to insulation, as it is quite possible that people will operate them with wet hands.

Wiring contractors occasionally fit an ordinary iron radiator with cotton flex in bathrooms, but this is a practice that should not be encouraged. There is no reason why a line of radiators should not be developed for bathrooms which would be both safe and very convenient.

If any maker has anything suitable, perhaps he will communicate it to your "Correspondence" column.

Radiator.

February 21st, 1920.

! Wages in the Aluminium Trade.—Representatives of employers and workers in the aluminium industry of Great Britain and Ireland met in conference last week, in London, to discuss a claim by the National Union of General Workers, the National Amalgamated Union of Labour, and the Workers' Union, for an advance of 15s. per week for all employed in the industry. The question of future relations between employers and employed in the industry was also discussed, and will be considered by a joint body.—*The Times.*

E

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A New Marconi Ammeter.

The accompanying illustrations represent the new type of hot-wire ammeter that was shown at the Physical Society's Exhibition by Messrs. Marconi's Wireless Telegraph Co., Ltd. In place of the usual single wire exerting a pull at the middle of the heated wire, there is a bifilar attachment, kept taut by a spring connected to the pointer; elongation of the heated wire allows the pointer to move. The hot wire circuit forms the secondary of a transformer, the primary of which carries the current to be measured; hence damage to the moving parts does not affect the main circuit, which is designed principally for wireless telegraph purposes. The secondary is mounted on an ebonite block, which can be moved to adjust the zero, carrying with it the whole of the moving parts, so that the calibration is not affected. Fig. 1 shows the 5-in. dial pattern, and fig. 2 is a sketch of the moving parts. The filament resistance is 0.685 ohm, that of the secondary 0.18, and of the primary 0.006 ohm, and the accuracy is within 2 per cent. for wave-lengths between 300 and 3,000 m. The safe overload is 20 per cent.

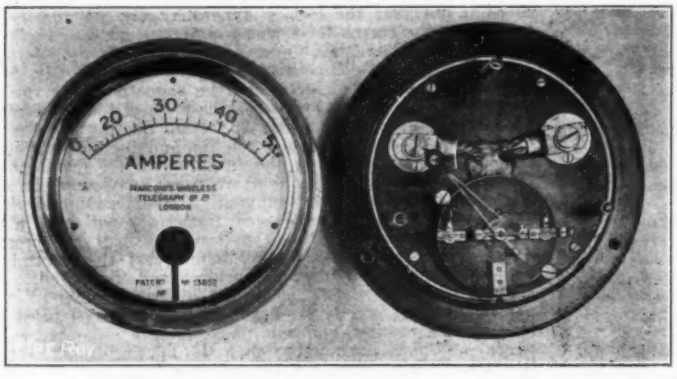


Fig. 1.—Marconi Hot-wire Ammeter.

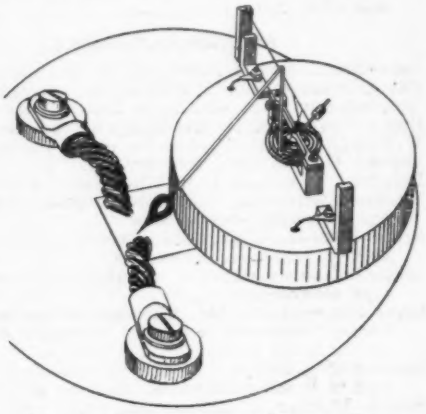


Fig. 2.—Arrangement of Moving Parts.

A Lamp Shade Tilter.

Messrs. Fitments, Ltd., of 58, Spital Street, Dartford, have recently developed a simple device for securing a lamp shade at any desired angle. As will be seen from the illustration (fig. 3) it consists of two parts, one of which is clamped between the two rings of the holder and the other pivoted to it, hooking on to the lamp cord.

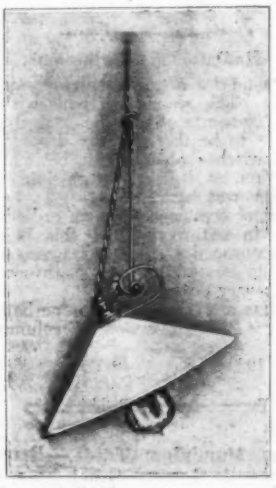


Fig. 3.—Grip Tilter.

A Coaxial Turbo Gear.

A recent issue of the *American Machinist* gives details of a new turbo gear recently introduced by an American manufacturing company. Fig. 4 is a sectional elevation of this type of gear. A is a shaft made from an alloy steel forging, possessing at one end a double helical pinion B which engages with three double helical planetary gear wheels C. These gears are bushed with bronze and revolve on the pins D, which are rigidly secured in a two-part steel cage E. One end of this cage has a stem, and the other three projections. G is a cage plate connected to the three projections of the cage by bolts F, making the planet gear housing practically a single piece, and affording a support for both ends of the pins D. The cage plate G has a central projection running in a ball-bearing, while the stem at the other end of the cage is the low-speed shaft H, which is also supported by a ball bearing. The inner end of the high speed shaft A runs in bearing I within the cage. This bearing has only a slight load. Rigidly keyed to the housing is the gear ring J with which the planet gears engage. K is a lubricating pump which distributes oil from a reservoir in the bottom to all parts of the gear. The entire mechanism is enclosed to protect it from dirt and moisure only the ends of the two shafts projecting. It is claimed that by means of this gear a speed ratio as high as 19 to 1 can be obtained. The device can either be used for stepping-up or stepping-down speeds, and, according to the makers, has an efficiency of from 98 to 99 per cent.

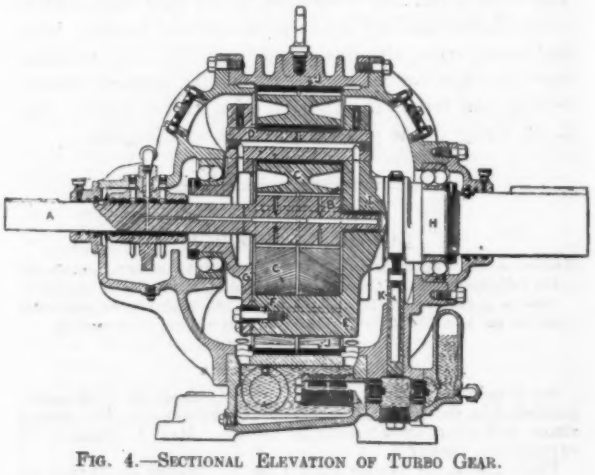


Fig. 4.—Sectional Elevation of Turbo Gear.

The Orling Jet Relay.—In our notice of this device on February 6th, a slip occurred, the current strength in the receiving coil when printing signals at the rate of 450 letters per minute being given as 4×10^{-13} ampere. The current was, in fact, 0.02 micro-ampere, and the resistance of the coil being 1,000 ohms, the *power* input was 4×10^{-18} watt.

BUSINESS NOTES.

Bankruptcy Department.—The Board of Trade announce that the Department of the Inspector-General in Bankruptcy has removed from No. 1, Horse Guards' Avenue, Whitehall, S.W. 1, to Great George Street, Westminster, S.W. 1. (Telephone Vict. 9800).

Catalogues Wanted.—The Superintendent of Stores, Mesopotamian Railways, has informed the D.O.T. that he desires to receive British manufacturers' catalogues of the following among other materials:—Rolling stock, pumps, motor-rail cars, permanent way material, workshop machinery, mathematical instruments, piping, general hardware, cranes, electrical plant and accessories, steam and oil engines, conveyors, elevators, and labour-saving devices generally. Publications should be sent to the Superintendent direct at Makinah, Mesopotamia.

German Stock Quotations in January.—The *Economic Review* gives a list of rises in German stocks and shares in January, from the *Deut. Allg. Ztg.* for January 31st. The following electrical securities appear:—

	Dec. 31st	Jan. 15th.	Jan. 30th.
Deutsch-Ueberseeische Elektrizitats-gesellschaft	915	760	955
A.E.G.	245	259	325
Felten & Guilleaume	246	293	405
Schuckert	151	184	215

Auction Sales.—By order of the Disposal Board, Ministry of Munitions, Mr. M. Marshall will sell by auction, on March 2nd, 3rd, 4th and 5th, at Georgetown, Glasgow, high-class engineering plant and machinery, machine tools, hydraulic power plant, electric motors, electrically-driven blowers, &c. For full particulars see our advertisement pages to-day.

In our advertisement pages again this week will be found particulars of important sales which are to take place at Shoreham Camp on March 3rd and 4th. Messrs. Harris & Gillow are the auctioneers, and the lots to be disposed of include a very large assemblage of building materials, timber, camp equipment, electrical appliances, and almost every class of hut.

By order of the Disposal Board, Ministry of Munitions, Mr. C. D. Phillips will sell by auction, on March 18th, at Swindon, valuable machinery, plant, stores, timber, &c. For full particulars see our advertisement columns this day.

E.D.A. Activities.—In view of the ever-increasing interest evinced by the public in matters electrical, it is well to learn something of the powers that are behind this move towards efficiency. A bulletin recently published by the British Electrical Development Association affords an opportunity of gaining an insight into the nature of its activities. The part of the Association's work that places facts and figures before the general public, supply undertakings and commercial enterprises, through the medium of the Press and other channels of publicity, although a very important branch, is by no means the only method by which the Association seeks to further the electrical cause. As a link between the industry and various Government departments, it has rendered invaluable service. The Board of Trade and the Ministries of Food and Health have constantly been consulted and informed on the multitudinous questions into which electricity enters, and the organisation has without doubt secured "official recognition." In connection with housing, the Association has grasped the opportunity of pointing out to Government officials, local authorities, architects, and engineers, the numerous advantages of incorporating an electricity supply in all building schemes, and in addition to this has furnished notes, reports, and lantern slides, for the use of lecturers and societies dealing with that important question. To assist the industry to arrive at a solution of what is at present an unsettled matter—a simple and more uniform treatment of various aspects of the industry—inquiries regarding tariffs, cooking apparatus, design, and housing, and electricity supply, are being made to ascertain the general view entertained upon these subjects by various authorities. These reports will be collated and circulated, and good results are expected.

Among the pamphlets lately issued by the B.E.D.A. are "Freedom from Domestic Worry," a reproduction of an appreciative letter by a satisfied housewife; "Do it Electrically," setting forth the advantages of electric fires, kettles, &c.; "Everybody wants Electricity," which is described as "a plea for public patience while machinery and organisation are preparing to meet the present overwhelming demand"—surely an indication of the success of the Association—and the last leaflet is an illustrated contrast between the kitchen of yesterday and the kitchen of to-day and to-morrow—a comparison of coal and electricity.

The British Electrical Development Association having been incorporated, we have received a copy of the Memorandum and Articles of Association. It will be noticed that the Association is now described as "The *British* Electrical Development Association." As previously explained, it was found necessary to insert the word "British" in order to secure sufficient variation from the title of another company already on the registers. In general practice, and in connection with publicity matter, the usual monogram "E.D.A." will be employed.

Electric Lamps Profiteering Sub-Committee.—The Electrical Lamps Sub-Committee of the Profiteering Act Department (Central Committee) held its eighth meeting on February 17th, and considered its draft report.

Trade Announcements.—MR. J. H. EDWARDS, joint managing director of Messrs. George Hill & Co., Ltd., electrical, mechanical and tramway engineers, 25, St. Ann Street, Manchester, who has been actively associated with the business for the past 20 years, has purchased the whole of the shares held by the late joint managing director, Mr. A. R. Walmsley.

The Ramsgate and District Electric Supply Co. has opened showrooms and offices in Queen Street.

As from March 1st, the head office of MESSRS. DRAKE & GORHAM, LTD., will be removed from 66, Victoria Street, where they have been established since 1886, to 36, Grosvenor Gardens, Westminster, S.W. 1. Telegraphic address, "Accumulator, Sowest, London"; telephone No., Victoria 9060 (5 lines). Stores and works addresses remain unchanged, viz.: Stores, 67, Long Acre, W.C. 2; works, Rockingham Works, Newington Causeway, S.E.

MESSRS. CHAS. CHURCHILL & CO., LTD., have opened a new branch office at 53, Bridge Street, Sheffield, to deal with increasing business in small tools and supplies.

Mexican Measures.—Mr. John Lind, who was at one time personal representative of President Wilson in Mexico, has published an interesting account of his experiences. The following extract from his book, "The Mexican People," contains a valuable hint to English firms interested in Mexican trade, particularly to those who come into competition with Germany in that country:—"We must get into line with the commercial world in the matter of weights and measures. I asked an intelligent German merchant in Vera Cruz one day to explain to me how it had come about that Germany had absorbed so much of the trade that at one time went to England. He reached into a drawer, pulled out an invoice from England, and said 'Do you see those denominations of yards, feet and inches, gallons and pints; pounds, two kinds of ounces, grains and pennyweights, the whole summed up in pounds, shillings and pence? Well,' he continued, 'a Mexican, even if he can read a little English, needs an interpreter and an accountant to put this into the language of civilisation. And,' he added, 'their business methods generally are just as antiquated as their methods of computation. That is why we get the business, and then we make, not what suits us, but what the trade wants."

Wage Demands at Port Elizabeth.—According to a Press report from Port Elizabeth, it appears that the Amalgamated Society of Engineers there recently presented a further demand for increased wages and reduced working hours. The City Council refused to accede to the demands, which a Special Committee characterised as a flagrant breach of the terms of the agreement previously entered into. A statement issued by the Committee shows that the daily wages paid in January, 1918, January, 1919, July, 1919, and the new demands respectively, were:—

Fitters: 13s. 8d., 16s., 20s., 27s. 4d.
Electricians: 12s. 8d., 17s., 20s., 27s. 4d.
Switchboard attendants: 7s., 10s., 13s., 19s. 1d.
Drivers: 10s. 6d., 12s. 6d., 16s., 21s. 9d.
Firemen: 10s. 6d., 12s. 6d., 16s., 21s. 9d.

The figures are based on an eight-hour day, and include all bonuses. The new demands include a reduction in working hours from 48 to 44 per week.

New Italian Electrical Companies.—Under the style of Stabilimento Meccanico Agostoni e Ca has been formed, at Milan, a company with a capital of 255,000 lire for the manufacture of motors and accessory plant.

Airaghi e Vittadini is the designation of a company formed at Milan for the manufacture of electric heating apparatus. Its capital is 35,000 lire.

Messrs. Damiani e Bonato have been established as a company at Milan with a capital of 50,000 lire, for the manufacture of electric apparatus.

At Turin has been formed a company under the style of Crespi e Garlasco, with a capital of 60,000 lire, for the trade in electrical articles and material.

For the manufacture of argon electric lamps there has been established at Turin, the Fabbrica Piemontaise Lampade Elettriche Argon, with a capital of 30,000 lire.

Swiss Engineering and Electrical Trades in 1919.—The *Neue Zürcher Ztg.* (January 13th and 14th) quotes from the December report of the Schweizerische Kreditanstalt the following regarding the Swiss engineering and electrical trades in 1919:—"In the engineering industry work was slack at the beginning of the year, owing to an absence of orders from abroad, upon which the industry depends. Later in the year matters improved, since many firms received orders in connection with the electrification of the Swiss railways. Production was of necessity reduced owing to the introduction of a 48-hour week. The increase of wages and salaries made the cost of production greater. In the electricity industry the factories were very busy after the first few months of the year, large orders for electrical machinery being received from N. France and Belgium, as well as from Swiss firms. The Gotthard railway management placed important orders for electric locomotives and alternate-current generators. In the later months of the year orders were received from Scandinavia, Italy, and England, in addition to increased orders from France.—*Economic Review.*

The Liverpool Electrical Dispute.—The Mersey District Committee of the Electrical Trades Union has addressed the following circular to electrical employers:—

"It has come to the notice of my committee that a circular, dated February 7th, 1920, has been addressed to you by Mr. L. G. Tate, the general secretary of the N.F.E.A. Certain of the statements in the circular are grossly inaccurate and misleading, and my District Committee desire to acquaint you with the exact situation. The circular states that the Electrical Trades Union in the Liverpool area have asked for wide concessions, and states that your Council have instructed the Liverpool members that the concessions may not be granted. It is alleged that the result is 'a complete withdrawal of labour from our Liverpool members.' There are two points involved here. First, the so-called concessions which it is alleged the E.T.U. are *asking* for were actually and unanimously agreed to by the District Joint Industrial Council for the electrical contracting industry, Mersey area. The terms do not represent the conditions which the E.T.U. are pressing upon a reluctant body of local employers, but something which the elected representatives of these employers on the District Joint Industrial Council have already agreed to *after five months' negotiation*. There is the strongest reason to believe that the Liverpool employers are prepared to put the conditions in force, at once, but that your Council are preventing them from doing so. To such an extent is this true that not less than 58 firms have already agreed to the conditions, and are now working to them. Then with reference to the allegation that 'the result is a complete withdrawal of labour from our Liverpool members.' This would give the impression that the E.T.U. had withdrawn the whole of its members. This is not true. The fact is that on January 20th, acting, it appears, under instructions from the National Council of the N.F.E.A., the Liverpool members *locked out* the members of the E.T.U., because of the employés at two firms having refused to work under the old conditions. The principle which the E.T.U. is fighting for is whether an agreement, drawn up by the local employers' association and the E.T.U., shall be put into force in accordance with the custom that has prevailed for many years, or whether the National Council of the N.F.E.A. shall be allowed to impose their will on the local representatives. So strongly do certain of the local members of the N.F.E.A. feel on the matter, that six out of the 28 firms comprising the branch have put the conditions in force themselves in defiance of your National Council, while yet another firm, under threat of resignation, was given permission to put the rules in force. The circular also omitted to state that before any rupture took place the E.T.U. offered to submit the question to an independent person to adjudicate. This offer was not accepted."

Lead.—In their report dated February 21st, Messrs. James Forster & Co. state:—

The conditions remain unaltered, and until imports increase substantially we must expect advancing markets and a growing scarcity of metal. It is scarcely realised that the quantity left for home absorption in the imports and exports of the last three months amount to 316 tons per week, or not sufficient to keep a single sheet lead mill going. Japan has been again in the market, as also has been Canada, but such business in the existing conditions should not be encouraged. Consumers here have not been active buyers of late, but are finding difficulty in obtaining delivery of what they have bought, owing to the delay in discharge of steamers at the docks.

Messrs. G. Cawson & Co. report:—

The position with regard to supplies remains unchanged. Arrivals are coming in quite freely, and there is plenty of lead available for all requirements—any surplus is still going into store. The delay in delivery from Australian steamers is again acute. This, however, does not now trouble receivers, as they are fully supplied with lead. The only weak point in the market is the immense supply of antimonial lead, which is now obtainable in large quantities at £10 to £12 per ton below the price of ordinary soft lead. It has been pointed out to us that our estimate of the present Australian production is considerably over-stated. We gladly correct this, and will give a fresh estimate as soon as we can get details together.

Agents in Overseas Markets.—The Press and the Department of Overseas Trade have repeatedly brought to the notice of United Kingdom manufacturers the necessity of appointing suitable agents in overseas markets in order that our trade in these markets may be established and maintained. So far many firms have shown a tendency to neglect the opportunities offered for appointing reliable agents, probably because they are very busy and cannot guarantee delivery. Commenting on this tendency, H.M. Trade Commissioner in Winnipeg states that the difficulties of the position in some industries are fully understood by importers and prospective agents, who are, however, still very anxious to open negotiations, even though deliveries at present may not be possible. Hesitancy on the part of United Kingdom manufacturers might be taken as an indication that Canadian business is not desired, and once this impression is gained the result will be that Canadian importers will turn to other (foreign) sources of supply. The Commissioner advises that reliable agencies should be arranged forthwith by United Kingdom manufacturers with reliable Western Canadian representatives. Such representatives would do a great deal of useful educational work until such time as deliveries can be made. He says: "A Western Canadian agent who represents a British house is proud of the fact, and does not hesitate to let the trade know it. Western Canada is apparently on the threshold of a period of great expansion and development, and its requirements in manufactured goods from now on will exceed any previous record." In certain lines of products the United Kingdom will need to make more strenuous efforts than heretofore to obtain a substantial share of Western Canada's trade. This applies particularly to all metal products, including machinery of all kinds, electrical equipment for power and lighting; engines, both stationary and portable; telephone construction equipment; automobiles, and hardware. "A large number of inquiries at this office for agencies from British manufacturers are in respect of the lines above named. In these lines the United States enjoys the bulk of the trade, and I would strongly urge that no opportunity should be missed in connecting reliable agents on this side with interested United Kingdom manufacturers. The time will come sooner or later when the United Kingdom will need every order that can be obtained, British manufacturers will then be glad of reliable connections previously made in Western Canada through which they can compete for business. Generally speaking, the American manufacturers will not let the fact that they cannot deliver at the moment interfere with making agency arrangements now. Whether they can make deliveries promptly or not they will continue to advertise their products, and keep their agents frequently posted as to every phase of their business. Agents have informed me that if they are unable to secure the representation of British firms, they will have no alternative but to turn to the United States for business connections."

"Safety First."—The first annual report of the British Industrial "Safety First" Association was presented at the general meeting of the members at the Mansion House on February 24th. The list of officers contains the names of a great many men eminent in the industrial life of the country, and includes Lord Leverhulme, Lord Ashfield (Sir Albert Stanley), Sir Auckland Geddes, M.P., Sir Kenneth Crossley, and Sir W. Joynson-Hicks, Bart., M.P., chairman of the London "Safety First" Council.

The report, in commencement, states that in consequence of the war, involving the fate of nations, the safety of individuals was apt to be overlooked, and it was not sufficiently appreciated that preventable accidents were responsible for a great deal of suffering and unrest, and acted as a drag upon the industry of a nation. Reference is made to the enormous strides made by American "Safety First" authorities, which have a total membership of over 3,700 undertakings employing more than 6,000,000 workers. Acknowledgment of the efforts of firms and trade unions in this country who have rendered valuable service, both personal and financial, is embodied in the report. Details are given of the methods by which the Association is furthering its object. Many special articles have been contributed to technical and trade journals, and special mention is made, in this connection, of the work of Sir Herbert Morgan, K.B.E.

In May, 1919, the first series of bulletins was issued, and at the close of the year 30,000 had been distributed, in addition to thousands of pamphlets mainly for workpeople. In December the official organ of the Association, *Safety First*, made its appearance. A gallant conduct award, as described in a recent number of the ELECTRICAL REVIEW, has been instituted for acts of bravery performed in the prevention of accidents at the works of associated firms. Valuable data regarding accidents are obtained by means of a form on which details are returned to the headquarters of the Association by employers. A form of publicity employed in London was the showing of lantern slides at the leading London kinematograph theatres. The Association was favourably commented upon by the Chief Inspector of Factories and Workshops in a report issued as a "White Paper" by the Home Office, and representatives of five Government departments have been officially permitted to serve on the Council. Attention is drawn to the statement of a firm which is a member of the B.I.S.F.A. that the number of cases treated at its "first aid" station was reduced from 1,300 to 600 by means of its first month's "safety first" campaign. An appeal is made for voluntary workers in each industry to review bulletins, criticise drawings and photographs as to accuracy and detail, and to suggest from experience subjects for propaganda.

The hon. secretary of the B.I.S.F.A. is Mr. H. E. Blain (operating manager of the London Underground Railways, &c.) with offices at 2 and 3, The Sanctuary, Westminster.

Touring by Motor Coach.—We have received a small brochure, bearing the above title, from the Lancashire United Tramways, Ltd., which forms a guide to the various districts served by the undertaking's motor coaches. It is profusely illustrated by photographs.

Electrical Plant in China.—There is a very large and increasing demand for electrical plant and machinery from all over China, and it is greatly to be regretted that the big British companies are not doing more to capture this trade. It is a business that needs a highly-trained technical staff, and, for that reason, it would be advisable for manufacturers to have their own offices and men here (Shanghai). At the present moment the British Municipal Council at Tientsin is calling for tenders for turbo-alternators. A large industrial undertaking here wishes to erect its own power-generating plant for 500 to 1,000 H.P., but it will not apply to any of the local firms because of the fact that they are only middlemen. It requires here a man who will advise the directors as to the best system the work of the undertaking requires.—*The Times Trade Supplement.*

Foreign Catalogues.—The Foreign Catalogue Library, commenced by the Department of Overseas Trade in 1915, has proved of great service to the British manufacturer. Nearly 2,000 firms have made use of the catalogues. They have benefited not only from the opportunity to study foreign competitive prices, but have also received useful ideas from designs of specific items, such as fancy metal goods. This has been especially the case with new firms. The catalogues are indexed under the class of goods and the name of the manufacturer, and are lent to the applicants for varying periods. The library now contains over 13,000 catalogues from all parts of the world, the majority being German and Austrian, but including American, French, Italian, Spanish, Portuguese, Dutch, and British Dominions. A section of the library covers mail order, shop and exhibition catalogues. A certain amount of difficulty is being met with in securing post-war catalogues. During 1919 nearly 9,000 catalogues were borrowed by over 600 firms.—*Board of Trade Journal.*

Book Notices.—*Faraday House Journal.* Vol. VIII, No. 5. Lent Term, 1920. London: Faraday House. This issue contains, besides the usual supply of notes and notices of interest to students, an article by Dr. Alex. Russell on "The Design of Distributing Mains," in which he, assuming that the demand is known, investigates how to proceed, and gives a few of the considerations that have to be taken into account. Elementary algebra only is used to discuss the somewhat difficult mathematical theorems that arise even in the simplest cases. Mr. S. O. Pearson, B.Sc., deals with the bridge method of testing condensers of low insulation resistance. The results of the final examination held at the end of the Summer Term are given, while the register shows a considerable increase in the number of students, both in college and at works.

"*Journal* of the Institute of Metals." Vol. XXII. 428 pp. and 31 plates. Edited by G. Shaw Scott, M.Sc. London: The Institute of Metals. Price 31s. 6d. net.—This contains, amongst other valuable matter, a verbatim report of the lecture by Prof. F. Soddy, M.A., F.R.S., on "Radio-Activity," and the communications and discussions at the recent Sheffield meeting. Amongst the many practical papers contributed are "Season Cracking," by Dr. W. H. Hatfield and Captain G. L. Thirkell, A.I.F., B.Sc., and one by a lady metallurgist, Miss Hilda Fry, and Dr. D. W. Rosenhain, F.R.S., on "Observations on a Typical Bearing Metal." The volume concludes with a section, of nearly 70 pages, devoted to abstracts of papers relating to the non-ferrous and allied industries, which have been compiled from the transactions of scientific societies and the technical Press of the whole world.

Revue de l'Ingenieur et Index Technique, Vol. XXVI, No. 1, January, 1920 (100 + xxvi. pp.). Contains articles upon the coal problem—the utilisation of lignite and inferior grades, &c.; a review of the situation regarding the reconstruction of the devastated areas of Northern France; notes on American and European steel works, &c. A brief *résumé* of the proceedings of the Académié des Sciences and the Société Française de Physique is also included, in addition to the very complete index of technical works.

"*Bulletin* of the U.S. Bureau of Standards," Vol. XIV, No. 4 (Scientific Papers Nos. 318 to 329 inclusive), 293 pp. Washington: Government Printing Office.—Included in this publication are papers on radiometry, metallurgy, photography (astronomical), &c., and one providing new formulæ for the calculation of mutual and self-induction.

"*Mechanical World* Year Book for 1920." Pp. 328 + 316 and diary. London and Manchester: Emmott & Co. Price 2s. net.—Several additions have been made to the Year Book, including sections on "Water and Hydraulic Work" and "Heating and Evaporating Liquids." Many of the original features have been extended and brought up to date.

"Flow and Measurement of Air and Gases." By A. B. Eason. Pp. xii + 252, 56 figs., and 31 tables. London: C. Griffin & Co., Ltd. Price 25s.

"Handbook of Physical Measurements." By E. S. Ferry. Vol. I: Fundamental Measurements, Properties of Matter, and Optics; pp. ix + 251, 142 figs. Vol. II.: Vibratory Motion, Sound, Heat, Electricity and Magnetism; pp. x + 233, 128 figs. London: Chapman & Hall. Price 9s. 6d. each volume net.

"Graphical and Mechanical Computation." By J. Lipka. Pp. ix + 264; 110 figs. London: Chapman & Hall. Price 18s. 6d. net.

"The Management Problem." By E. T. Elbourne. Pp. ix + 144. London: The Library Press, Ltd. Price 4s. 6d. net.

"General Conditions in Electrical and other Engineering Contracts." By W. S. Kennedy. Pp. vii + 110. London: Sweet and Maxwell. Price 12s. 6d. net.

"The Baudot Printing System." By H. W. Pendry. Pp. v + 184; 91 figs. London: Sir I. Pitman & Sons. Price 6s. net.

"Mr. Touch-Button, or the Home of Beautiful Ideals." By Nancy Berry (48 pp.). London: "Country Life," Ltd. Price 3s. net. This "story for children, written by a child," is a tale of an "all-electric" house, cleverly written and well illustrated. Mr. Herbert H. Berry, apologising to Rudyard Kipling, contributes a revised version of the popular "If," and an epilogue explaining the circumstances under which the story came to be written.

British Engineering Standards Association publications:—No. 71, "British Standard Specification for Two-pin Wall-plug and Sockets"; No. 79, "Report on British Standard Special Trackwork for Tramways"; No. 98, "British Standard Specification for Goliath Lamp Caps and Lampholders." 1s. 2d. each post free from the offices of the Association, 23, Victoria Street, S.W. 1.

Catalogues and Lists.—Mr. E. J. Hill, of 29, Ludgate Hill, E.C., has issued a pamphlet on "Advertising—A Factor in Trade Expansion," in which the expert advertising service that he is prepared to render is described, examples of his designing work being shown.

Messrs. Ross & Co., 62, Robertson Street, Glasgow.—List Section P. An illustrated and priced catalogue of electric bells and bell indicators.

The Cressall Manufacturing Co., Staniforth Street, Birmingham.—List 1,920, containing priced and illustrated details of "Cressall" electric sterilisers and water boilers.

The British Thomson-Houston Co., Ltd., Mazda House, 77, Upper Thames Street, E.C. 4.—"Incandescent Electric Lamp Handbook, No. 1B" (64 pp.). A combined catalogue of "Mazda" lamps and handbook of useful information regarding electric lighting. Definitions of lighting units, a glossary of trade terms, and several curves and diagrams are included, and the publication forms a valuable reference handbook for both electricians and those outside the industry.

The L.P.S. Electrical Co., Avenue Road, Acton, W. 3.—Two leaflets dealing with current-carrying test-clips for making quick temporary connections and battery-charging clips. Illustrated and priced.

Standardisation of Gears.—At the request of the Machine Tool Trades Association, a conference, under the ægis of the British Engineering Standards Association, has been arranged to discuss the question of the standardisation of gears.

Primarily, its purpose is to give the industry an opportunity of deciding whether standardisation in this field would be practicable.

The subject of gears generally appears to cover too large a field to make it susceptible of any great degree of general standardisation. It is probable that whilst the conference will, in the first instance, be obliged to take a brief survey of the whole subject, any proposed investigation from the point of view of standardisation will have to be narrowed down to attacking a few definite points in some particular branch of the industry.

American manufacturers are devoting considerable attention to this question, and as the B.E.S.A. is in close communication with the American industry through the American Engineering Standards Committee, such a conference as is now proposed should do much to bring British manufacturers together at a most opportune time, as well as promote Anglo-American co-operation on what is acknowledged to be a most important subject to the industries of both countries.

The conference is to be held under the direction of the Sectional Committee on Machine Parts, their Gauging and Nomenclature, on March 5th next, at 2.30 p.m., at the Institution of Civil Engineers, Great George Street, S.W. 1. Any individual firm or expert who has not received a communication with regard to the conference, and who is interested in the question, is invited to communicate with the Secretary of the British Engineering Standards Association, 28, Victoria Street, S.W. 1.

For Sale.—Portsmouth Corporation invites tenders for the purchase and removal of five Lancashire boilers; Newcastle-on-Tyne Corporation Tramways and Electricity Department has for sale 380 Brockie-Pell arc lamps and 30,000 carbons; Southampton Corporation Electricity Committee are prepared to consider offers for one Parsons-E.C.C. turbo-alternator set, with surface condensing plant and exciter, &c. Poplar Borough Council Electricity Department has for disposal one 1,300-kw. and two 1,000-kw. Parsons-Bruce Peebles turbo-alternators, complete with condensing plant; Accrington Corporation Electrical Engineering Department invites offers for one compound boiler feed pump, one mechanical water cooler, one mechanical water cooler converted as a wet air filter, and a quantity of cast-iron piping. For particulars see our advertisement columns to-day.

When in Rome—Call on the Consul.—H.M. Commercial Counsellor in Rome remarks "that it would certainly be in the interests of business men generally if they made a habit of calling upon him, and on the Consuls where they are transacting business. Experience has proved that while people never fail to appeal to the Consul when in need of assistance they frequently omit to call and discuss commercial matters. If a practice of doing so were made, both they and others might derive considerable advantage from business information and experience."

Merchandise Marks Committee.—At the meetings of the Merchandise Marks Committee, which were held at the Board of Trade on Thursday and Friday, with Mr. Joseph Hood, M.P., in the chair, the effects of the compulsory marking of foreign goods with an indication of their origin, and of the use of a National Trade Mark, were dealt with by witnesses from a number of Chambers of Commerce and associations.

Electric Grills and Irons for Panama.—It is reported from the British Consular Office at Colon that the Commissary Department of the Canal is experiencing difficulty in obtaining electric grills and irons from the United States, owing, it is said, to the abnormal demands received by manufacturers, particularly for electric irons, during the past year, and to the fact that it is becoming increasingly hard to obtain the necessary raw material. Any British manufacturers who are in a position to quote for these goods should address communications to the Purchasing Agent, Commissary Department, Panama Canal, 24, State Street, New York.

Concerts.—The employés of Messrs. Pope's Electric Lamp Co., Ltd., held their second concert on 17th inst. We understand that the event was even more successful than the first, held a month ago.

The Halifax Tramways Club held a smoking concert last week to welcome the returned ex-service men. Mr. Galloway, tramway engineer, presided.

The Swiss Glow-Lamp Industry.—It is stated that the American Westinghouse Co., which as lessee of the Bollag glow-lamp works in Aarau has carried on this branch for some years past, has now acquired the works by purchase for the purpose of extending the manufacture of lamps in that country.

Dinner.—Ex-service members of the Blackpool Corporation Tramways and Electricity Institute were entertained to a welcome-home dinner and smoker on Friday last, when 150 participated in an enjoyable programme. Mr. Charles Furness, the borough tramway manager and electrical engineer, presided.

Prolongation of Patent.—An application for the prolongation of a patent expiring next July, by the owner, Mr. C. Smith, was before the Chancery Division last week. The Act of 1919 automatically prolonged the life of the patent by two years, and Mr. Justice Sargant ruled that an application two years before expiration was premature, as the question whether the patentee had been adequately remunerated could not be decided until near the end of the life of the patent. The petition was adjourned accordingly.

Importation of Copper Cable into Australia.—A December newspaper just to hand states that by Official Proclamation in the Commonwealth *Gazette* the importation of stranded copper cable into Australia, save under licence from the Minister of Customs, is prohibited.

Joint Industrial Council.—The inaugural meeting of the District Council (No. 4) of the Monmouthshire Joint Industrial Council was held at Cardiff on February 12th, the Lord Mayor presiding. Alderman A. Sinclair, J.P., Mayor of Swansea, was elected chairman, and Mr. J. L. Davies, of the E.T.U., vice-chairman. The constitution already formulated was approved. Mr. Rees Llewellyn said that basic rates should be adopted at once to arrest the dissatisfaction spreading among the workers of the district.

New French Company.—La Société d'Entreprises de Réseaux Electriques is the name of a new company which has lately been formed in Paris (33, Avenue des Champs Elysées), with a capital of 1,000,000 francs, to engage in the establishment of electricity distribution systems.

The Non-Ferrous Mining Committee.—The Committee appointed by the Board of Trade, under the chairmanship of Mr. H. B. Betterton, M.P., to inquire into non-ferrous mining in the United Kingdom, has now completed the taking of evidence, and is preparing a report which it hopes to present in a few weeks' time.

Liquidations.—SPARKING PLUG PATENTS, LTD.—Winding up voluntarily. Liquidator, Mr. F. B. Lodge, of Rugby. Meeting of creditors will be held at 61, Temple Row, Birmingham, on March 11th.

ENFIELD ELECTRIC CABLE MANUFACTURING CO., LTD.—A meeting is called for March 29th, at Central House, Finsbury Square, E.C., to hear an account of the winding-up from the liquidator, Mr. W. L. Smith.

Bankruptcy Proceedings.—E. BOHM, electric lamp manufacturers, 5, Boxworth Grove, Barnsbury, N. Order for bankrupt's discharge granted on consenting to judgment being entered for £15.

LIGHTING AND POWER NOTES.

Argentina.—WATER POWER.—The *Economic Review* states that a report has been submitted to the Government by a Berlin engineer relating to the proposed harnessing of the Iguassa Falls. The latter are situated on the Brazilian frontier, at the junction of the Iguassa and Panama Rivers. The potentialities of the falls are as great as those of Niagara, and, it is said, they have a greater available head. This undertaking will form the subject of negotiations between the Governments of Argentina and Brazil.

Australia.—VICTORIA.—Extensive boring in the Morwell brown coal fields, upon which £3,000,000 is to be spent for the production of a cheap power supply, has proved that in an area of 1 sq. mile there is between 120,000,000 and 150,000,000 tons of coal. This is calculated to be sufficient to maintain an output of 100,000 H.P. for a period of 150 years. The total resources are estimated to be 20,000 million tons.

Bexhill-on-Sea.—LIGHTING PRICES.—The Corporation has considered suggestions that, in view of the reduction in cost of coal, the charges for electric lighting, &c., should be reduced. The committee regrets that the present position does not justify any lowering of prices for electric light. Reserve funds, which before the war had been accumulated, have been completely absorbed. Labour and general costs conditions, apart from the cost of coal, are so different from what Parliament could be expected to contemplate over 20 years ago, when a maximum price of 8d. per unit was fixed, that the committee considers the town is to be congratulated on there not having been occasion to apply for power to increase the maximum charge.

Continental.—DENMARK.—A sum of 5,137,000 kroner is being spent on enlarging the plant at the Copenhagen municipal power station. A new turbo-generator with boiler equipment is to be installed. The Soroe municipal authorities have decided to take over the local gas and electricity undertakings.

FRANCE.—The Union Française d'Electricité is building near Paris the largest power station in Europe (400,000 H.P.). The Zoelly type has been adopted for the steam turbines, the orders for which are being shared with the American industry. In Europe they have been divided between the Société Alsacienne de Construction Mécanique at Belfort; Schneider & Co. at le Creusot; and Escher, Wyss & Co., at Zürich. All the turbines will be of 60,000 H.P.—*Economic Review.*

SPAIN.—The Compania Anonima Mengemor de Electricidad has recently commenced working on a hydro-electric station at Carpio, on the Guadalquivir. The available head averages over 60 ft., and the total power which will be developed is 7,000 H.P. The plant is to consist of three 3,500-H.P. turbines connected to 3,000-volt three-phase generators. Transmission will be effected at pressures of from 25,000 to 30,000 volts.

Cupar (Fife).—ELECTRICITY SUPPLY.—The Town Council has been advised to proceed at once with a scheme for supplying electricity for power, lighting, and heating, and a Committee has been appointed to deal with the matter.

Dublin.—STREET LIGHTING.—As a protest against the order necessitating the possession of permits by persons in the city between midnight and 5 a.m., the Corporation has decided to switch off all street lighting at 11.30 p.m.

East Midlands.—WHITLEY COUNCIL.—A conference of representatives of the Industrial Council of East Midland electricity undertakings and of factories and workmen's unions was recently held at Nottingham. The Council has been constituted upon the basis of the Whitley scheme to deal with all labour matters affecting public and private works in the area, including South Notts., South Derbyshire, South Leicestershire, South Lincolnshire, Rutland, and Northants, with the exception of Peterborough. A Committee consisting of 24, in equal proportions, representing employers and workmen's unions, had been appointed at a previous meeting to consider the proposed constitution, a draft of which was presented and deferred for further consideration at another conference.

Ennis (Co. Clare).—LIGHTING SCHEME.—A public meeting discussed the proposal to form a company for an installation of public electric lighting, and a committee was appointed to consider details. It is estimated that £15,000 will be required.

Hamilton.—NEW PLANT.—A 500-KW. rotary converter is to be added to the plant at the Corporation power station.

Ilfracombe.—OPPOSITION TO BILL.—The Urban District Council is to petition the House of Lords to prevent the Bill being promoted by Edmundson's Electricity Corporation and others becoming law. Dartmouth Corporation is associated with Ilfracombe in this protest.

Leicester.—NEW POWER STATION.—The Corporation has under consideration proposals for the erection of a generating station which will have an ultimate capacity of 30,000 KW. The first part of the plant to be installed, if the sanction of the Electricity Commissioners is obtained, will be two 10,000-KW. turbo-generators with the necessary boilers, coal and ash-handling gear, &c. The estimated cost of the scheme, including buildings, is £600,000.

Liverpool.—BREAKDOWN.—A breakdown of one of the sets at the Liverpool power station on the morning of February 21st, was responsible for the tramway service in several areas of the city being held up for one hour. Within 20 minutes of the breakdown, repairs were effected which made a modified service available, and an hour afterwards the whole system was resumed.

Londonderry.—PRICE INCREASE.—The Corporation has increased the charges for electric lighting and power by 50 per cent.

Lowestoft.—LOAN.—The T.C. is applying for sanction to borrow £3,993 for the purpose of plant extensions and contingencies.

Nottingham.—PRICE OF POWER.—At a recent meeting of the Corporation, the price charged for power (2½d. per unit) was adversely commented upon, as it was stated to be a hindrance to the prosperity of the district. Coventry and Wolverhampton were quoted as towns making a reasonable charge for electrical power.

Oldham.—WORKING EXPENSES.—The Corporation electrical engineer reports that for the fortnight ending February 11th, the expenses of the undertaking totalled £3,012 15s., equal to ·867d. per unit, compared with £1,815 16s., equalling ·702d. per

unit, for the corresponding period last year. The units sold totalled 833,908, a record in the undertaking's history. Last year's figure was 620,165. Coal per unit generated was 2·78 lb., compared with 2·80 lb. last year.

Preston.—House Lighting.—The tramway engineer is to report to the Housing Committee with regard to the possibility of supplying electricity to the Holme Slack and Ribbleton sites, from the tramway power station.

Inadequate Supply.—The National Electric Supply Co. has intimated to the Corporation that the increased output following upon the extension of the company's plant will only be sufficient to meet the demands of applicants already waiting. Further requirements will have to be met by the bulk supply the company is to receive from Blackburn, which, it is stated, may not be available until next year.

Ryde (I.O.W.).—Price Increase.—The Isle of Wight Electric Light and Power Co. has increased the price of energy as follows from the date of the December meter readings:—First 300 units per quarter, 8d. per unit; next 3,000, 4d.; beyond, 3d.

South Africa.—Ladysmith.—The price of electricity is being raised from 9d. to 10d. per unit.

Beaufort West.—The municipality proposes to raise a loan of £13,000 for the installation of an electric lighting scheme.

Spalding.—Electric Lighting.—The Urban District Council has rejected a proposal to apply for a prov. order for electric lighting. It is stated that private firms are putting in their own installations, owing to dissatisfaction with the gas supply provided by the Council.

Taunton.—Loan.—The Town Council is applying for a loan of £3,000 for transformers, motors and extensions of mains and services.

Warrington.—Inadequate Supply.—A joint meeting of manufacturers and representatives of the Corporation was held on February 19th for the purpose of considering ways and means of meeting the urgent demand for electrical power for industrial purposes. Mr. Rylands, for the manufacturers, said that if the Corporation was unable to supply the necessary power, manufacturers would have to arrange to provide it themselves. Dr. Joseph, chairman of the Electricity Committee, stated that the output of the present plant was already at a maximum, but a scheme was at present under consideration which would involve an expenditure of £500,000.

TRAMWAY AND RAILWAY NOTES.

Australia.—Tramway Trust Report.—The report of the Prahran and Malvern Tramways Trust for the year ended September 30th, 1919, states that owing to a strike of employés, revenue was decreased by £3,600, and a seamen's dispute caused a further loss of £7,460. The total income for the year was £214,728, and expenditure £195,331. The net surplus was £3,580, of which amount £3,529 went to the constituent councils, and £51 to the City of Melbourne.

The undertakings controlled by the Trust, and other similar bodies, have lately been taken over by the Melbourne and Metropolitan Tramways Board.

Blackburn.—Alteration to Track.—The Oswaldtwistle Urban District Council has approved the Corporation's proposal to alter the tramway lines near the Blackburn Road railway bridge.

Bradford.—Improved Service.—The tramway difficulties are gradually being overcome. At one time the Saturday service of cars got down to as low as 140; now the number is 170. Eighteen of the new cars are now working, while other eight are undergoing the painting process. This completes the first order of 26 cars, but there are another 20 also on order. The greatest difficulty has been the lack of motors, but the supply of these has greatly improved. In another month or two there will be a very decided improvement.

Burnley.—Fare Increase.—The balance-sheet of Burnley tramway department shows a deficit on last year, despite greatly increased traffic. This will necessitate an immediate increase in fares up to the highest legal amount. The last increase in fares took place in June, 1918, but the financial result has not proved sufficient to meet the situation.

Continental.—France.—The Société Hydro-Electrique des Pyrénées has applied for leave to construct a fall of 365 metres from the River Nagear, yielding 3,000 h.p., which is to be wholly utilised by the Castelet carbide of calcium factory.

Sweden.—Railway Electrication.—Ever since 1905, the Royal Waterfalls Commission and the Board of Directors of State Railways have made investigations concerning the utilisation of the country's water-power for the electrification of the State railways. Interested firms were invited in 1908 to prepare their proposals, and the directors found that the one emanating from the Allmanna Svenska Electriska Aktiebolaget, in conjunction with another company, was most advantageous for the State and in the best interests of the Swedish industries. In accordance with the joint proposal of the two companies, a single-phase alternating-current system with a frequency of 15 cycles would be used for the electrification. The economic advantages of the system are most apparent when used for long sections with heavy trains, where it is required to transmit comparatively large amounts of power over long distances, at reasonable cost. The difficulties with this system were considered to be mainly of a technical nature in connection with the design of the electrical equipment for the locomotives, especially as machines of the capacity required had not been built at that time. Porjus has many interesting features to offer from an hydraulic engineering point of view. At the source of the Lule River, in the Great Lule Lake, begins a 3½ km. long stretch of rapids, approximately 8 metres high, below which a smaller lake, the Great Porjusselet, is located. Immediately below Porjusselet are the real Porjus falls, which extend approximately 2 km. down the stream. At the lower end of Porjusselet is constructed a dam by means of which practically the whole head in the small so-called Luspe Rapids above Porjusselet is made available. The length of the dam is no less than 1,254 metres, and the gross head after construction of this dam averages 56 metres. The damming up of Porjusselet is, however, only sufficient for the weekly regulation. On one side of the dam are arranged intakes for the power station canal, which is approximately 600 metres long. The canal is open for the first part, but enters the rock as a tunnel on the left side of the river, and emerges in front of the power station, where a small fore-bay is arranged. By means of the closed intake tunnel, the dangers from ice formations are reduced. The power station is partly located underground, blasted down in the rock to a depth of 50 metres. Only the switchgear building is located above ground. Five vertical penstocks lead down from the forebay to the turbines, from which a common tailrace tunnel, approximately 1,200 metres long, returns the water to the river basin at the so-called Lilla Porjusselet, a smaller still water below the Porjus Rapids. This peculiar method of construction was due to the local conditions, and has been found after investigation to be the cheapest and most reliable. The machinery hall, which is completely blasted out from the rock, has a width of 11 metres and a length of 95 metres. From one of the sides extend the 15-metre deep and approximately 6-metre wide recesses for the turbines. Space has been provided in the now completed portion for five turbines, but only four have been installed as yet. Of these, two are connected to single-phase generators for railway service, one to a three-phase generator, and one to a spare set consisting of a three-phase generator and a single-phase generator connected together. All the turbines are designed for a capacity of 12,500 h.p. each: At a later extension, the machinery hall will be enlarged to make room for an additional development of five turbines, also to be divided between the single-phase and three-phase systems.—*Journal of the Swedish Chamber of Commerce.*

The scheme for the extension of electrical working on the Swedish State railways, which was prepared by the State Railway Administration has been delayed by the Hydraulic Department. It is considered that adequate water-powers are available for the purpose, but some time is required for determining the manner in which the supply of power to the railways will be made. The railway authorities are said to desire single-phase current of from 15 to 16⅔ periods, and the question has to be examined as to how this shall take place, as the generators at the existing hydro-electric works are generally for 50 periods.

Holland.—It is reported from Rotterdam that the Dutch Government is to dispatch a commission to the United States to investigate the systems of electric railway working in that country. One-half of the members have been appointed by the State Water Department and the other half by the Administration of the Netherlands Railways. The commission will also inspect electric railways in Europe, and will eventually present a report as to the system best suited to the requirements of those of the Dutch railways which are to be electrified.

Germany.—Owing to strikes, wage increases, &c., the Berlin tramways undertaking showed a deficit of 19,000,000 marks for 1919. On January 1st the fare was raised, but, in spite of this, the continued increase of working expenses has resulted in the loss of a further 1,000,000 marks.

Italy.—Steps have been taken to adapt the Corgola torrent for the generation of electricity, to be employed in connection with the development of the metal-bearing beds which run from the Lago d'Iseo to near Manive, a distance of 20 km. It is estimated that there are 5,000,000 tons of iron ore in this area, which was known and worked in the time of the Romans.

The Società Elettrica Bresciana is carrying out some noteworthy plans of development. It has under construction two new hydro-electric stations—the Selvanizza and the Scoltella, both on the River Cedra. The former, when completed, will develop 32,000,000 kw. at an estimated outlay of 4,500,000 lire; the latter will cost 4,600,000 lire, and will involve the construction of a reservoir of 500,000 cb. metres content, and a machinery equipment comprising two groups of 3,500 h.p. each. It has also begun work on the conversion of Lake Idro into a reservoir.

The Chamber of Commerce of Turin gives the following particulars of the big Italian railway electrification scheme which has been officially sanctioned. The scheme contemplates electrifying 6,000 kilometres of railways worked by the State, or in course of construction, and railways or tramways the subjects of concessions, in working or under construction. An outlay of 800,000,000 lire is authorised, which will be spread over eight financial periods from 1919. For the financial year 1919-20, the sum of 60,000,000 lire is allotted. The works will be carried out either directly by the State railway administration or with the help of private industry, under the control of the administration. The supply of electric locomotives

will be undertaken by the railway administration. The current will be obtained from private sources. The programme contemplates, first, the electrification of heavy traffic lines, in a certain number of passes through the Apennine mountain chain, and the principal arteries of the Peninsula network, stretching from Milan to Reggia Calabria and from Turin to Trieste. It is the intention of the administration to set up in the Apennines central stations in places where lignite and turf can be used, in order to create reserves for the Alpine network. In the North, the resources of the Trentino region are fully sufficient for the growing wants of the region. In these first operations, it is hoped to effect a yearly saving of 1,500,000 tons of coal, without reckoning the reduced consumption in local industries.

Huddersfield.—Track Renewals.—The tramway lines in various parts of the borough are being re-laid.

Jamaica.—Railway Electrification.—An exhaustive report has been received by the Government of Jamaica from an expert of the Westinghouse Electric International Co. on the proposal to electrify the railway of the Colony, and to provide energy for other industrial purposes. The report deals with the harnessing of two large rivers for the purpose. The estimated cost of electrifying the railway, including the required power station, equipment, and transmission lines to supply other proposed plants and industries, is as follows:—

Power plants	$849,320
Sub-stations	333,320
Overhead construction and bonds	1,854,300
Motive power—electric locomotives and motor-cars —net (cost of new, less sale of old motive power)	357,650
Total	$3,393,590

The saving in the cost of operating the railway would be approximately $265,600 per annum, which is 7·83 per cent. of the cost of electrification. This assumes the sale of power to outside consumers at actual cost. The sale of power to outside consumers would result in a profit sufficient to increase the return on the cost of electrification to approximately 10·5 per cent. It is shown that conditions other than reduced cost of operation in the immediate future justify electrification of the railway at the earliest possible date. It is proposed that some of the power, if the scheme is carried out, should be used to operate plants on some of the sugar estates, to supply current for the sewerage works in Kingston, and to provide for the lighting of the thoroughfares of the city and other districts.—*The Times Trade Supplement.*

Lancashire.—Employes' Wages.—In the event of the present application of the tramway workers for a 10s. per week increase being granted, it will have a serious effect on many undertakings. At Rochdale, it is stated, it will mean an increased wages bill of £10,000 per annum, and £12,000 at Bolton.

Leeds.—Proposed Fare Increase.—There is a likelihood of the tramway fares being increased in the early future, as it is stated the department is not paying its way. The present fare in Leeds is 1½d. for two miles. A meeting of the Tramways Committee took place last week, but no definite proposals were formulated.

London.—Tramways, &c., Bill.—The estimates required by the Standing Orders of Parliament have been prepared by the London County Council, showing in detail the expenditure of capital that will be required in the event of sanction being given to the Council's Tramways and Street Improvements Bill of the present session. The total expenditure is estimated at £5,118,500. Of this sum £3,363,500 is estimated to be required in connection with and for the construction and equipment of the proposed new tramways and the reconstruction of the embankment tramways, £1,355,000 is required for a new street and street wideningas, and £400,000 is to provide omnibuses from or to any point within the county, or beyond the county, but within the Metropolitan Police District.—*The Times.*

Underground Reconstruction.—At the annual meeting of the City and South London Railway Co., Lord Ashfield said that the cost of re-building the line would be £2,300,000.

Mansfield.—Extension of Time.—The Light Railway Co. has applied to the Ministry of Transport for an extension of time until April 9th, 1922, for the completion of railways at Sutton-in-Ashfield and Skegby.

TELEGRAPH AND TELEPHONE NOTES.

Another Atlantic Cable.—President Mackay, of the Mackay Companies, in his annual report, announces a plan to lay another cable to Europe because of the present great volume of business. The organisation has been buying debentures of the Commercial Cable Co. in London, taking advantage of the low sterling exchange.—*The Times.*

European Telegraphs.—At the outbreak of war direct telegraph circuits between England and Europe were interrupted, and the circuits, the Continental terminals of which were in possession of the Allies, were taken over for military purposes. Within the past few months direct commercial service has been gradually restored, and the British Post Office now has direct wires from London to the following places:—Bordeaux, Boulogne, Calais, Dunkirk, Havre, Lyons, Marseilles, Nantes, Paris Central, Paris Bourse, Genoa, Milan, Rome, Antwerp, Brussels, Ghent, Amsterdam, Hague, Rotterdam, Berlin, Bremen, Cologne, Dusseldorf, Emden, Frankfort-on-Main, Hamburg, Leipzig, Madgeburg, Berne, Geneva, and Zurich.

Finland.—A telephonic connection between Tornea and Haparanda is being planned. The Director of Telegraphs will shortly place before the Finnish Government a proposition that the State should construct a telephonic installation from Uleaborg to Tornea. By this means it would be possible to telephone from Sweden to the most remote parts of Finland.—*Economic Review.*

Italy.—The *Economista Italia* states that wireless stations have been opened at Misurata and Azizia, in Tripolitania, subject to the tariff fixed in Tripoli. The Thié station, subject to the tariff fixed by Eritria, has also commenced working.

United States.—The New York telephone service has fallen grievously from its former state of efficiency. Since the Armistice it has steadily and rapidly deteriorated until to-day, says *The Times*, "There is no more despised and abused institution in the world." The vice-president of the company has issued a plea for mercy to the public. He admits that the service is bad, and cannot promise any real improvement for many months. According to him, the daily average of calls in New York before the war was 2,000,000. This number had increased to 4,000,000 on the first of the present year. Yet all through the war the telephone industry was classified as non-essential, with the result that the company was unable to make new extensions to meet the amazing growth of traffic. To add to its difficulties, its staff of operators is short by 3,000. The company intends to spend during the next 12 months £7,200,000 in establishing new exchanges, and to add £400,000 to the amount of its pay-roll.

It is announced that the U.S. Government will return to private operation, on February 29th, all private wireless stations taken over during the war period.

Wireless Time Signals.—The *London Gazette* of February 20th contains an Admiralty Notice to Mariners, No. 316 of 1920, which cancels former Notice, No. 171 of 1920, containing general information and a list of wireless time signals intended to provide, in a form suitable to give all information required by the wireless operator, a complete and up-to-date list of all time signals issued by wireless stations throughout the world.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—Melbourne.—March 30th. City Council. 12,000 metal filament incandescent lamps. (February 6th.)

April 12th. City Council. Two 2,000-kw. rotary converters; H.T. switchgear, 6,600 v.; D.C. switchgear, 600 v. (January 30th.)

Belfast.—March 10th. Electricity Department. Stores, including meters, cables, electrical accessories, lamps, carbon brushes, &c. (February 20th.)

March 22nd. Electricity Department. Coal-handling plant. (February 20th.)

Chester-le-Street (Co. Durham).—March 3rd. Urban District Council. Underground mains and all equipment for lighting district by electricity. Mr. F. J. Gray, Clerk, Council Offices.

Doncaster.—March 2nd. Electricity Department. Two 3,000-kw., three-phase turbo-generators, with condensing plants. (February 20th.)

Dundee.—Tramways Committee. Stores for a year, including armature coils, commutators, insulated wire, lamps, switches, &c; overhead equipment materials. Mr. P. Fisher, General Manager.

Edinburgh.—March 29th. Electricity Supply Department. Condensing plant for Portobello station. Specification No. 23. (See this issue.)

France.—March 5th. French State Railway authorities, 43, Rue de Rome, Paris. Tenders for an electric lighting and power installation at the new railway works at Sotteville Quatre-Mares, near Rouen.

March 2nd. French State Railway authorities, 43, Rue de Rome, Paris. For the supply and laying of two three-phase high-tension cables between the La Garenne Chatou and St Germain sub-stations.

Gellygaer.—March 21st. Urban District Council. Transformer plant, H.T. and L.T. switchgear, 11,000 v. and 500 v.; overhead line material. (See this issue.)

Gillingham.—February 28th. Electric Light and Power Department. Two 700 to 800-B.H.P. combined Diesel engines and alternators. (February 20th.)

Corporation. Two 3-ton steam or 3-ton electric travelling jib cranes.

Hebburn.—Electric lighting of the premises of the New Town Working Men's Social Club. Specifications from the Stewards.

Halifax.—March 12th. Tramways and Electricity Committee. One 1,000-KW. turbo-alternator, with condenser. (See this issue.)

Hammersmith.—March 3rd. Electricity Committee. Stores for 12 months, including electric light sundries, insulated wire, meters, jointing compound, &c. (February 13th.)

Lincoln.—March 2nd. Electricity Department. One automatic battery, for St. Swithin's Power Station. (February 6th.)

London.—Great Central Railway. March 17th. Stores for 12 months, including electrical line construction, electrical apparatus, wires, cables, lamps, &c. Specifications from Mr. W. Williams, Stores Superintendent, G.C.R., Gorton, Manchester.

H.M. Office of Works. March 12th. Electrical accessories for 12 months. (See this issue.)

Macclesfield.—March 15th. County Asylum. Electrical goods for six months. Mr. W. G. F. Tingay, Clerk.

Merthyr Tydfil.—March 9th. Board of Guardians. Electrical fittings for six months. The Workhouse Master.

New Zealand.—DUNEDIN.—April 26th. City Council. (*a*) electric car bodies; (*b*) car trucks; and (*c*) car equipment. Documents may be consulted by British firms interested, at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, S.W. 1 (Room 49).

Plymouth.—March 18th. Electricity Committee. Turbo-alternator, converter and booster. (See this issue.)

CLOSED.

Croydon.—Town Council :—

Dust destructor, South Norwood.—Meldrums, Ltd., £13,884.

Epsom.—Urban District Council :—

Distributing mains and laying.—Siemens Bros. & Co., Ltd., £7,332 (less £349 credit for old copper, and adjustment of labour rate, £154).

London.—STEPNEY.—CORRECTION.—In our list of the tenders submitted to the Borough Council (see ELEC. REV., February 20th, page 242) the price quoted by the Mirrlees-Watson Co., Ltd., for condensing plant, is incorrectly given. It should be £14,960 *not* £16,960.

FULHAM.—Electricity Committee. Recommended :—

Feed-water heater, £328.—Worthington, Simpson & Co.

South Africa.—LADYSMITH.—Corporation. Accepted :—

Two Babcock & Wilcox water-tube boilers, with mechanical stokers, superheaters, filters, &c.—Messrs. Reunert & Lenz. Delivery is expected about the middle of April.

FORTHCOMING EVENTS.

Royal Institution of Great Britain.—Saturday, February 28th. At Albemarle Street, W. At 3 p.m. Lecture on "Positive Rays," by Sir J. J. Thomson, Pres. R.S.

Faraday Society.—Monday, March 1st. Joint meeting with the London Section of the Society of Chemical Industry.

Society of Engineers.—Monday, March 1st. At Burlington House, W. At 5.30 p.m. Paper on "Some Engineering Work done by the 277th Railway Co. (R.E.) in France and Belgium During the War," by Mr. R. H. Cunningham.

Rontgen Society.—Tuesday, March 2nd. At the Royal Society of Medicine, Wimpole Street, W.C. At 8 p.m. Third "Silvanus Thompson Memorial" Lecture on "Analysis by X-rays," by Prof. W. H. Bragg, F.R.S.

Liverpool Engineering Society.—Wednesday, March 3rd. At the Royal Institution, Colquitt Street. At 8 p.m. Paper on "Water-tube *versus* Cylindrical Boilers in the Mercantile Marine," by Mr. E. A. Atkins.

Association of Engineering and Shipbuilding Draughtsmen.—Wednesday, March 3rd. At 7.30 p.m. At the Engineering Lecture Theatre, Liverpool University. Mr. D. H. Tates, A.M.I.M.E., on "The Una-Flow Steam Engine." Thursday, March 4th. At 8 p.m. At Milton Hall, Manchester. Mr. Peter Doig on "The Screw Propeller." Friday, March 5th. At 7.30 p.m. At the Applied Science Department, Sheffield University. "Flat Plates," by Mr. C. C. Pounder, A.M.I.M.E. Friday, March 5th. At the Technical School, Barrow-in-Furness. Mr. M. Cronel on "Gearing Design."

Institution of Electrical Engineers.—Thursday, March 4th. At the Connaught Rooms, Great Queen Street, W.C. (7 for 7.30 p.m.). Annual dinner. Informal meeting. Monday, March 1st. At the Institute of Patent Agents, Staple Inn Buildings, W.C. At 7 p.m. Lecture on "The Future of Labour in the Engineering Industry," by Mr. R. E. Dickinson.

(**Western Centre.**)—Monday, March 1st. At the Merchant Venturers' Technical College, Bristol. At 7 p.m. Lecture on "Electric Clocks," by Prof. D. Robertson.

(**Students' Meeting.**)—Friday, March 5th. At the City and Guilds (Engineering) College, South Kensington, S.W. At 7 p.m. Address by the President.

British Industries Fairs.—At the Crystal Palace, London; Castle Bromwich Aerodrome, Birmingham; and the Kelvin Hall, Glasgow. Open until March 5th.

Junior Institution of Engineers.—Friday, March 5th. At 39, Victoria Street, S.W. At 7.30 p.m. Lecturette on "Notes on Gauge Testing and Measuring Appliances," by Mr. F. H. Holt.

NOTES.

The 25,000-KW. Turbo-Alternator at Manchester.—In our article on the new plant at Stuart Street generating station, Manchester, last week, the generating set was inadvertently described in the foot-lines to figs. 2 and 4 as a "Metropolitan-Vickers Turbo-Alternator." This description was correct so far as the alternator was concerned, but the turbine and condensing plant, as stated in the body of the article, were supplied by the chief contractors, Messrs. Richardsons, Westgarth & Co., Ltd., of Hartlepool. The turbine is one of their standard combined impulse-reaction turbines of the Brown-Boveri type, except for modifications made by the firm to suit the special conditions at Manchester.

Smoke Abatement.—Dr. Addison, the Minister of Health, has appointed a Committee to consider the present state of the law as regards the pollution of the air by smoke and other noxious vapours, and to advise what steps are desirable and practicable to diminish the evils still arising from such pollution. Lord Newton will be chairman of the new Committee, and Mr. E. C. H. Salmon, of the Ministry of Health, will act as secretary; any communication should be addressed to him at the Ministry of Health, Whitehall, S.W. 1.

The Status of Engineers.—Application will be made to the Legislative Assembly of the Province of British Columbia at the next session on behalf of the Association of Professional Engineers of British Columbia for a private Bill to be known as the British Columbia Engineering Profession Act, for the purposes of governing and regulating the practice of civil, mining, metallurgical, mechanical, electrical, and chemical engineering in that province, the qualification, examination, and registration of intending practitioners, discipline of members, and so on.—*Electrical News.*

Parliamentary.—In the House of Commons, last week, the following Bills were read a second time :—Central London and Metropolitan District Railway Companies (Works) Bill, L.C.C. (General Powers) Bill, London United Tramways Bill, and the South Metropolitan Electric Tramways Bill.

The *Daily Telegraph* says that objection was taken to the second reading of the Metropolitan Electric Tramway Bill, and also to the London Electric Railway Companies' Bill, which deals with an increase in fares.

Record of Electrical Plant Installed During the War.—The head of each naval establishment on shore is requested by the Admiralty to arrange for a summarised description of all new electrical plant installed during the war in the establishment under his superintendence, to be forwarded at an early date. Any new applications of electricity made during the war are also to be reported, and a comparison made with pre-war plant and methods. This information is required in connection with the preparation of a Technical History of the War by the section of the literary staff at the Admiralty, of which Commander Rollo Appleyard, R.N.V.R., is the head.—*United Service Gazette.*

A Dot-and-Dash Duck.—A correspondent writes :—A neighbour of mine who bought some ducks a few weeks ago found that one of them was exceptionally intelligent, and had an unusually loud and penetrating voice. He had a friend living about 200 yards away, to whom he had often wanted to send short messages. My neighbour, who during the war was a wireless operator on one of his Majesty's ships, soon discovered that if he took the duck up in his arms, it rapidly responded with a long-drawn qu-a-a-a-a-ck when he gently pulled its tail and held it for a second or so, and that it also readily shot out a short sharp quack when he pulled the tail and let go instantly. He now sends his messages by Morse code to his friend, who is looking for an equally intelligent duck with a voice of 200 yards' range with which to reply.—*Morning Post.*

A.O.E.C.—The annual meeting of the Association of Officers and Staff Members of Electricity Companies was held at Caxton Hall, on January 30th, and was well attended. In moving the adoption of the report, the chairmain, Mr. A. E. Beale, said that the Association was to be congratulated on Sir Alexander Kennedy having accepted the presidency of the Association and on the imposing list of vice-presidents; several prominent officials had declined nomination, being of the opinion that they could more effectually assist if they were not officially connected with the A.O.E.C. The Chairman then touched shortly on the ramifications of the Association during the year, and laid particular stress on the Executive Committee's work in connection with the Electricity Supply Bill. This had resulted in the embodiment of Clause 16 in the Electricity (Supply) Act, 1919, containing all the essential provisions embodied in the corresponding clauses of the Acts constituting the Metropolitan Water Board, Port of London Authority, and Ministry of Transport. He concluded by paying a high tribute to the hon. secretary, Mr. O. M. Andrews, for his devotion to the interests of the Association, and for his efforts in connection with the Bill. The retiring Executive Committee and officials were then re-elected for the ensuing year. It was resolved that a testimonial should be presented to the hon. secretary in recognition of his services to the Association.

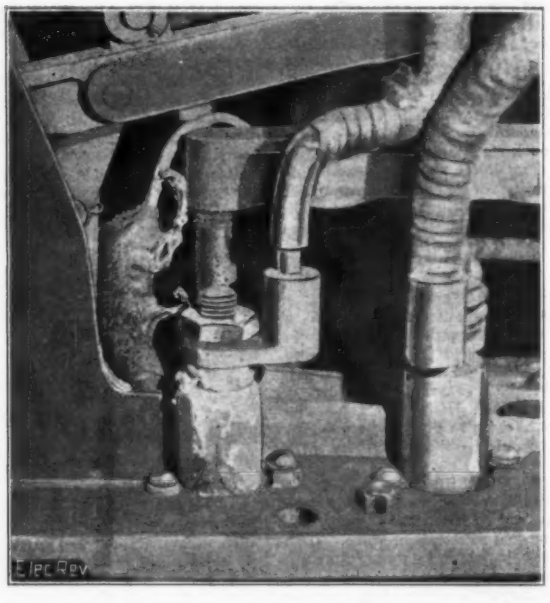
German Exhibitions in 1920.—During 1920 general exhibitions will be held at Leipzig, Breslau, Frankfurt-on-Main, Königsberg, and special exhibitions in Berlin, Düsseldorf, Elberfeld, Königsberg, Leipzig, and Stuttgart.—*Times.*

X-Ray Kinematography.—The daily Press announces that two French medical men, Dr. Formon and Dr. Comandon, have produced a combined X-ray and kinema apparatus which, it is claimed, permits the filming of the interior of animals so as to show on the screen all the movements of the various organs. The apparatus is expected to be of great assistance to medical science, especially in the training of students. The films allow every movement of the organs to be watched on the screen, and any irregularity noted.

Appointments Vacant.—Telegraph mechanicians (£250 + £170), for the Government of the Gold Coast Posts and Telegraph Department; shift engineer (85s.), for the Whalley County Asylum; mains assistant (£105 + 20 per cent. + £90), for the Portsmouth Corporation Electricity Department; sub-station attendant (79s. 10d.), for the Bootle Corporation Electricity Works; mains engineer (£300), for the Wigan Borough Council Electricity Department; plumber-jointer (81s.) for the Bolton Corporation Electricity Department; junior charge engineer (£100 + 20% + £90), for the Barrow Corporation Electricity Department. See our advertisement pages to-day.

The Calcutta Corporation is inviting applications until May 1st, for the post of lighting superintendent. A lengthy advertisement, stating the gas and electrical duties, salary, conditions, &c, will be found in *The Times* for February 23rd.

Tale of a Rat.—An electrical breakdown of an unusual but, unfortunately, not unprecedented nature, is illustrated in the accompanying reproduction of a photograph taken at the Daimler Co.'s Radford works. On a recent Thursday night the supply suddenly failed, and a lengthy investigation of the electrical



equipment resulted in the finding of the body of a badly burnt rat, which had apparently attempted to walk across the high-pressure terminals of an oil-immersed switch. Thereby it started a short-circuiting current, which had persisted and formed an arc, with disastrous results, as will be seen in the illustration, to the rat, and also to the main switch.

Fatalities.—An inquest was held, on February 19th, into the cause of the death of Harold Bligh Hill, aged 30, an electrician, employed in the L.C.C. sub-station, Upper Street, Islington, the previous Saturday night. He and a man named Frank Antill went to their duties as usual, and about two o'clock deceased went down into the basement to clean up; having removed the screens, although the live pressure was on, he proceeded to clean one side of the switchboard using no gloves, whereas under the regulations, he should not attempt to do any cleaning to the apparatus while the pressure was on. The telephone bell ringing, Antill went to answer it, and when he returned to the basement he found the deceased lying down by the side of the switchboard, apparently in an unconscious condition; he summoned the police surgeon, who found life was extinct, there being burns on both hands. Dr. B. H. Spilsbury, the Home Office expert pathologist, who had made a post-mortem examination of the body of the deceased, proved that death was due to an electric shock. Mr. T. L. Horn, electrical engineer in charge of the electricity distributing system, said that after the occurrence he examined the apparatus and found all in order. Deceased, to do the cleaning work, should first have made certain that the pressure was off and the switchboard dead, and under no circumstance should he have done the work whilst the current was on, for such was highly dangerous, and he was by rule forbidden to do such work alone. It seemed that he went to do the work whilst his mate had gone upstairs to attend to the telephone, and whilst the latter was away it was possible, owing to his having removed the screen, for him to have slipped over a mat, and, in trying to save himself from falling, put out his hands, which came in contact with the live metal. The Coroner recorded a verdict of "Accidental death."

The Sydney *Evening News* reports an inquest on Miss E. G. M. H. Vidal (30), at Wollongong, who was ironing, when she was heard to scream, and was found standing by the table with her hands "twisted round an electric iron." When the iron was prized out of her hands she fell to the floor, and could not be revived, though attempts to restore animation were carried on for 1½ hours. Mrs. C. Markham said she had received a shock from the iron previously. Miss Vidal's slippers were damp, and an inspector for the City Council, Mr. E. F. S. Murphy, said he found the frame of the iron alive. If she had been on a dry floor, and had had dry footwear on, she would not have received the shock. The verdict was "Accidental death."

The G.E.C. All-Electric House.—On Friday, last week, at the invitation of the General Electric Co., Ltd., a Press visit to the "All-Electric House" exhibited by the company at the Ideal Home Exhibition, took place; there was a very large attendance, and great interest was manifested in the house and its equipment, which was described in our issue of February 13th. Great credit is due to the company for the enterprise of which this unique exhibit is the embodiment; as we have repeatedly pointed out, the scarcity and high price of domestic help have brought the subject of labour-saving appliances in the home into the forefront, and have created an ideal opportunity for that development of the applications of electricity in the household which is so long overdue. The comfort and convenience afforded by the electrical equipment of the house are sufficient to induce a craving for their realisation in the breast of every housewife who inspects the installation, and the exhibit should exercise a marked influence on progress in this branch of the electrical industry.

Presiding at a luncheon given by the General Electric Co. to its guests at the Clarendon Restaurant, Mr. Hugo Hirst said he was disappointed with the part played by electricity at the Ideal Home Exhibition; there had been a gap of six years, during which the apparatus had remained in much the same stage of development as in 1914. Before the war the domestic appliance industry could not be developed as it should have been, because the supply authorities would not push the business adequately; nevertheless, an order for 2,000 electric ovens was put in hand by his company—then the war put a stop to the work, electric heating and cooking and other domestic uses of electricity being forgotten in view of the more important problems that they had to face. Now they were starting again where they left off; they would "get there" all right, but before these apparatus that were exhibited could be used in their millions, they must lay down factories and produce the goods cheaply enough to enable the general public to adopt them, and they must also ensure that electrical energy should be provided here at as low a price as anywhere. Although labour and coal were costly, electricity would play a fundamental part in the national reconstruction; they must endeavour to produce the KW.-hour for one-tenth of a penny, or even less. Then all houses would be fitted electrically, at the cost of shillings, where pounds were now quoted. That was his view of the problem, and the way in which it should be solved; only thus could the real "electric home" be attained.

In reply to the toast of his health, Mr. Hirst remarked that he could employ thousands more men but for the Trade Union restrictions on output, which delayed the building of the new factories which the General Electric Co. was erecting.

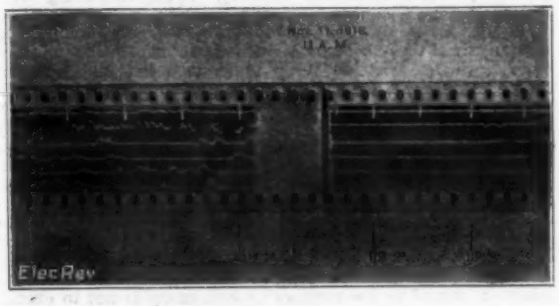
The arrangements for the visit were in the hands of Mr. H. Clifford Palmer, and were admirably organised and carried out.

Volunteer Notes.—The Volunteer Signal Company of the Royal Engineers, which was formed in Glasgow in 1918, with Major E. T. Goslin as commanding officer, has been disbanded. With the consent of the contributors to the fund which was raised by the Scottish Centre of the Institution of Electrical Engineers and the Electrical Contractors' Association, Major Goslin has now handed over a balance of £197 to the Benevolent Fund of the Institution of Electrical Engineers.

Canals and Inland Waterways.—At a meeting of the Royal Society of Arts held on February 18th, Mr. A. Neville Chamberlain, M.P., who presided, stated that the financial condition of inland waterway undertakings was due to the competition of the railways which were subsidised by the State. He considered that the work of improving matters in this direction should be carried out by the Government, as private undertakings would not see in the scheme a paying proposition. Mr. Chamberlain suggested the formation of Committees to control and operate the canals and inland waterways.

Electrolytic Copper in France.—According to *La Journal Industrielle* of February 6th, for which we are indebted to the Department of Overseas Trade, a company known as Hydro-electrique et Métallurgique du Palais during the war constructed a hydroelectric plant at Le Palais (Vienne), 2 km. from Limoges, and a works for the production of electrolytic copper, in order to secure a measure of independence of America in the supply of copper for war purposes. The works was laid out and equipped for an annual output of 12,000 tons of electrolytic copper. The company is contemplating the construction on the Taurion, a tributary of the Vienne, of new hydroelectric works for similar purposes, but in view of the existing conditions no date can be assigned for their completion.

The End of the War.—The recording tape illustrated below, which we reproduce from the *Journal of Electricity*, presents a remarkably graphic history of "the end of the war," over a year ago, November 11th, 1918. It is the tape from an American electrical listening instrument on the battle front, used to locate enemy batteries, and is calibrated to show fifths of a second of time. With photographic accuracy it shows the cessation of artillery activity on the American sector near the river Moselle, at 11 o'clock on the day of the Armistice.



END-OF-THE-WAR RECORD.

The perfection of sound-ranging devices is typical of the many services rendered by engineering and technical enterprise toward the winning of the world conflict. These were among the scientific instruments which the Germans were never able to produce successfully for themselves. The uncanny accuracy of this sound-detecting equipment is indicated by the record of one instrument which located 117 gun positions in a single day. The recording microphones were so delicate that their use had never been considered possible outside of laboratories, yet they were employed with success amid the din and concussion of heavy bombardments. So accurately did their data check, that enemy gun positions could be determined within 50 ft. by instruments several miles away.

Electricity Supply in Victoria.—We have received from the Secretary to the Electricity Commissioners of Victoria, Australia, their report on the utilisation of brown coal and water-power for the production of electrical energy, which leads them to the following conclusions:—That the necessary steps should be taken to inaugurate a State scheme for the supply of electrical energy, and that for this purpose a power house of an initial capacity of 50,000 KW. should be established on the Morwell brown coal field, at a cost, including the transmission lines and sub-stations, estimated at £2,737,392. It is important that the scheme should be in operation early in 1923. Hydroelectric power schemes are in the meantime deferred, pending the completion of investigations now in progress. The Morwell power house should be linked up with the Newport power house, and both operated under the control of a single authority. Research work on brown coal should be continued; the coal field should be opened up for the supply of fuel to the public, and the manufacture of briquettes should be tried. A sum of £150,000 is required to house the workmen, and £30,000 for briquetting plant, bringing the total estimate up to £2,917,382. The Commissioners recommend that a reduction of import duties should be obtained on items of plant required for the scheme that cannot be made in Australia, particularly the alternators.

We are informed that the report has been adopted by the Victorian Government, the Bill has been passed, and steps are being taken to proceed with the scheme at once.

Relative Costs of Coal and Oil.—The *Board of Trade Journal* has recently published figures collected by H.M. Commercial Secretary at Washington, showing that, although a few years ago there was a saving of 10·2 per cent. in the use of oil fuel, as compared with an equivalent quantity of coal, the prices of the two types of fuel have not risen in equal ratio, and so the present balance is slightly in favour of coal. In the Chicago district, for instance, the percentage increase in the cost of oil during the last few years has been 280, while the price of coal has only advanced 67 per cent. These figures are based on heat values only, plant efficiency in the case of oil being greater than that obtained by the use of coal.

Scientific Research in Australia.—A Bill which, when it becomes law, will create the "Commonwealth Institute of Science and Industry," is now on its course through the Federal Legislature. The underlying idea of the measure is to establish a body that will carry out scientific research work in relation to (1) the primary industries, and (2) the manufacturing industries. It will co-ordinate the scientific work which is now being undertaken by the States, will prevent overlapping and so ensure greater efficiency. The Institute is to be controlled by a Directorate of three scientific directors, who have not yet been appointed. They will be responsible to the Minister for Trade and Customs. Pending the passage of the Bill, the Advisory Council of Science and Industry, established in March, 1916, is preparing the ground, and is exercising in a preliminary way the functions that will belong to the future Institute. Researches into many problems affecting Australia have already been initiated and other investigations previously in progress have been encouraged and co-ordinated. Amongst other matters, a scheme for the creation of an Australian Engineering Standards Association has been prepared and approved by engineering associations and leading engineers throughout the Commonwealth. Conferences for the standardisation of structural steel sections, railway rails and fishplates, and tramway rails have already been convened, in each case with entirely successful results.—*Board of Trade Journal.*

Hydraulic Power in the Rumanian Rivers.—H.M. Commercial Secretary at Bucharest has reported through the D.O.T. that according to an estimate of the hydraulic reserves of Rumania published in the *Bulletin* of the State Railways there is a total of 841,093 H.P. which could be transformed into energy. This conclusion is based upon the flow in the rivers at the driest season of the year. In order to arrive at the actual H.P. available it would appear to be the practice to increase this by 150 per cent., a course which brings the total available H.P. up to 2,250,000. The *Bulletin* states that in 1913 only 41,000 H.P. was exploited.

INSTITUTION NOTES.

Belfast Association of Engineers.—Under the auspices of this Association a paper on "The Ultimate Constitution of Matter" was read by Mr. W. C. Ward, at the Municipal Technical Institute, on February 19th. Mr. Alex. Browne (president), occupied the chair, and there was a good attendance.

Institution of Mechanical Engineers.—The annual report for 1919 states that grants in aid of research work during the year were as follows:—Alloys, £220; steam-nozzles, £150; hardness tests, £150; and cutting tools, £100. Mr. A. F. Shore, of New York, was awarded a grant of £20 from the Sir Robert Hadfield Prize Fund, for a paper on "Hardness Determination," and a grant of £7 for his paper on "The Measurement of High Degrees of Hardness," was made to Mr. J. Innes. The accounts show an income of £22,684, against an expenditure of £24,843, a loss on the year of £2,159.

E.P.E.A.—The annual dinner of the North-Eastern Division was held on the 17th inst., at the Savoy Restaurant, Newcastle-on-Tyne, under the presidency of Mr. A. S. Blackman, M.I.E.E., M.I.M.E.

Mr. A. L. Lunn, Past President of the E.P.E.A., in proposing the toast of "The Guests," said he was pleased to note the presence of so many chief engineers. The Association was not looked upon with favour when it commenced its activities, but events had proved that it was started at the right time. He had recently read in the journal of the Electrical Trades Union, that "there was only one fly in the ointment, and that was the E.P.E.A.," and they were going to dig it out, but the E.P.E.A. was here to stay, and its work should have commenced 25 years ago.

Mr. R. P. Sloan, C.B.E., M.I.E.E., in responding to the toast, said he had always felt a great interest in the work of the E.P.E.A. He noted that the membership of the Association had increased by 40 per cent. during the previous year. The E.P.E.A. had been a benefit to the electricity supply industry, as it had been the means of compelling the employers to come together. The objects of the E.P.E.A. were laudable ones, and they could rely upon his sympathy and support.

Mr. E. Moxon proposed the toast of the E.P.E.A., and Mr. C. Vernier, M.I.E.E., in response, indicated the work of the Association in connection with the Electricity (Supply) Act, and the issue of Award No. 9,281. In his opinion, the most important work that the Association had accomplished, was the formation of the National Joint Board of Employers and Staff Members (Electricity Supply Industry). This Board was actively engaged at the moment in the consideration of the minimum salaries of the technical staffs of the undertakings, and its work was of great importance to all concerned.

An interesting and enjoyable musical entertainment was provided to the appreciation of all present.

Royal Institution.—On March 8th and 10th Sir John Cadman's postponed lectures on "Modern Development of the Miner's Safety Lamp," and "Petroleum and the War," will be delivered.

Physical Society of London.—At the annual general meeting on February 13th, Prof. C. H. Lees, F.R.S., delivered his presidential address, on "The Temperature of the Earth's Interior." The foundation of an International Union of Physics was unanimously approved, and it was announced that Prof. W. H. Bragg, C.B.E., F.R.S., had been elected president, the secretaries being Mr. D. Owen, D.Sc., and Mr. F. E. Smith, O.B.E., F.R.S.; foreign secretary, Sir Arthur Schuster, F.R.S.; and treasurer, Mr. W. R. Cooper, M.A.

Bradford Engineering Society.—At a meeting at the Technical College on February 16th, Major S. Utting, M.I.M.E., A.M.I.E.E., lectured on "Induced Draught for Boiler Installations," with special reference to the 'Prat' System." The chair was occupied by the President (Mr. W. Leach).

Institution of Electrical Engineers.—The third ordinary meeting of the LIVERPOOL SUB-CENTRE was held, on February 16th, at the University, Liverpool, when Lieut.-Col. F. C. Aldous, D.S.O., and Mr. A. L. Scanes delivered a joint lecture on "Electric Power Supply in the Rhine Valley." Prof. E. W. Marchant presided over a large attendance of members. Lieut.-Col. Aldous delivered the first part of the lecture, which dealt with the Electrical Features of Power Supply in the Rhine Valley, Mr. Scanes following with a brief description of the Mechanical Features. The lecture was illustrated by a large number of interesting lantern slides. A discussion followed, in which Messrs. Dickinson, T. D. Clothier, W. Lang, Ohlson, Povey, and the chairman took part. The lecturers suitably replied.

OUR PERSONAL COLUMN.

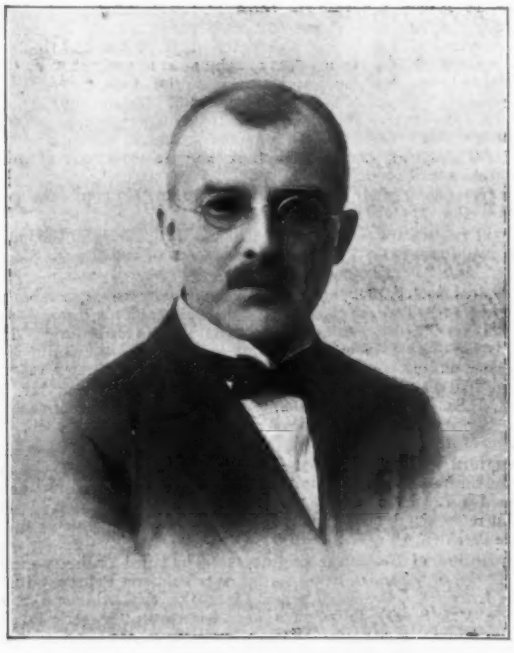
The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

The Electricity Commissioners.—In our last issue we published the announcement of the appointment of four of the Electricity Commissioners—Sir John Snell, Mr. H. Booth,

Photo by] [*Keith Dannatt.*

SIR JOHN F. C. SNELL.

Mr. W. W. Lackie, and Mr. A. Page—with portraits of the two last named. We now have pleasure in reproducing the portraits of the Chief Electricity Commissioner, Sir John Snell, and Mr. Booth. In our issue of June 26th, 1914, p. 1075, we had already given a short biography of Sir John



H. BOOTH.

Snell, together with his portrait, on the occasion of his knighthood, whilst he was president-elect of the Institution of Electrical Engineers.

It is believed that the fifth Commissioner will be Mr. Hayward, of the London County Council.

On November 19th, the Hackney B.C. referred back to the Establishment and General Purposes Committee for further consideration the recommendation to increase the salary of Mr. L. L. ROBINSON, the borough electrical engineer, from £750 to £1,050 per annum, rising to £1,200 per annum. On proceeding to further consider the matter, the committee had before it a communication dated November 24th by Mr. Robinson, asking for remuneration in accordance with the scale authorised by the Associated Municipal Electrical Engineers (Great Britain and Ireland). After conferring with the Electricity Committee on the question, a joint meeting of the two committees passed a resolution expressing the opinion that the above-mentioned scale should be adopted from April 1st, 1920, it being understood that the addition to the basic salary for new consumers should not exceed £250 in any year. The salary for the year commencing April 1st, 1920, under the scale, will be made up as follows: Basic salary £1,000, plus £169 additional for consumers, plus £175 10s., being 15 per cent. to cover the extra cost of living in London, plus £134 10s., an over-all 10 per cent. increase for depreciation of money values, giving a total of £1,479. The committee recommends: That as from April 1st, 1920, the scale of salary of the A.M.E.E. (Great Britain and Ireland) be adopted in respect to the salary of the borough electrical engineer on the understanding that the addition to the basic salary in regard to the number of consumers is not to exceed a maximum of £250 in any year.

Mr. F. C. WILSON has been elected chairman of the Liverpool Tramways Committee, in succession to Ald. Russell Taylor.

We are informed that Mr. E. G. BAKER has resigned his appointment with the Morecambe Corporation electricity works.

After two months' holiday on account of ill-health, Mr. F. H. RUDD, Corporation electrical engineer at Rochdale, has now resumed duty.

Wigan Tramways Committee has appointed Mr. R. HOGGARD, formerly chief traffic assistant to the Sheffield Corporation Tramways, to be traffic superintendent, at £275 per year.

Liverpool Tramways Committee has decided to recommend the City Council to appoint Mr. P. PRIESTLEY as general manager of the Corporation tramways, to succeed Mr. C. W. Malling.

Stirling T.C. has increased the salary of the electrical engineer, Mr. W. R. MURRAY, by £50 a year to £350.

Obituary.—MR. E. G. WAY.—The death has occurred, at the age of 37 years, of Mr. Edwin George Way, of the firm of Wort & Way, electrical engineers, of Salisbury, and Radnor House, Downton, Wilts.

NEW COMPANIES REGISTERED.

Electroducer, Ltd. (163,977).—Private company. Registered February 12th. Capital, £2,300 in 40 "A" shares of £50 each and 6,000 "B" shares of 1s. each. To acquire patents and rights, to enter into agreements with manufacturers for the right to manufacture and sell the company's electric cooking appliances, and to enter into an agreement with C. H. Lauth. The first directors are: C. H. Lauth, 11, Highbury Mansions, N.1; T. Jacob, The Oaks, Barnet Lane, Elstree; T. Plant, 98, Balham Park Road, S.W.; G. Maunsell, 116, Grosvenor Road, N.5. Registered office: 324, Upper Street, Islington, N.

R. W. Crabtree & Sons, Ltd. (163,908).—Registered February 10th. Capital, £600,000 in £1 shares (300,000 5 per cent. cumulative preference). To carry on the business of electrical, manufacturing, mechanical, motor, hydraulic and general engineers, fitters, founders, boiler makers, &c. Minimum cash subscription, 7 shares. The first directors are: C. H. Crabtree, Water Lane, Leeds; A. E. Crabtree, Water Lane, Leeds; E. Gillett, Hawthorn Road, Willesden Green; A. Terrey, 28, Keith Road, Hayes, Middlesex. Qualification, £3,000. Remuneration, £200 each per annum (£50 extra for the chairman). Solicitors: Ashurst, Morris, Crisp & Co., 17, Throgmorton Avenue, E.C.

Radio Press, Ltd. (164,035).—Private company. Registered February 13th. Capital, £100 in £1 shares. To carry on the business of proprietors and publishers of newspapers, journals, magazines, books, &c., dealing with radio telegraphy and telephony, submarine signalling, &c. The subscribers (each with one share) are: B. Binyon, 34, Norfolk Street, W.C., managing director; E. A. B. Snoaden, 34, Norfolk Street, W.C., secretary. Table "A" mainly applies. Registered office: 34, Norfolk Street, W.C.

West Yorkshire Motors, Ltd. (164,097).—Private company. Registered February 14th. Capital, £5,000 in £1 shares. To take over the business of a wire worker carried on by F. G. Brockway, at Providence Street, Elland, Yorks., and to carry on the same and the business of manufacturers of and dealers in electric motors and dynamos, generating plant, &c. The subscribers (each with one share) are: F. G. Brockway, 24, Waverley Road, Elland, wire manufacturer; E. Turner, 18, Huddersfield Road, Elland, electrical engineer. The subscribers are to appoint the first directors. Registered office: Providence Street, Elland, Yorks.

Standard Electric Welding Co., Ltd. (164,324).—Private company. Registered February 20th. Capital, £5,000 in 10s. shares. To carry on the business indicated by the title, and to adopt an agreement with the Shipbuilding and Engineering Appliances Co., Ltd. The first directors are: J. D. Andrew, 24, Grainger Street West, Newcastle-on-Tyne, consulting engineer; W. J. Pickersgill, Eden House, Newcastle Road, Sunderland, shipbuilder; T. H. Pattinson, 2, Esplanade, Sunderland, shipbuilder; T. W. Crozier, 25, Marine Terrace, Blyth, shipbuilder; J. H. Readhead, East Garth, South Shields, shipbuilder. Registered office: 24, Grainger Street West, Newcastle-on-Tyne.

Technical & General Advertising Agency, Ltd. (164,186).—Private company. Registered February 17th. Capital, £1,000 in £1 shares. To carry on the business indicated by the title. The subscribers (each with one share) are: H. E. Littlewood, 9, Ashburnham Gardens, Upminster, solicitor's clerk; T. Harvey, 58, Thornhill Road, N.1, solicitor's clerk. Table "A" mainly applies. Solicitors: Vint, Hill & Killick, Commercial Bank Buildings, Bradford.

London Mica and General Supply Co., Ltd. (163,926).—Private company. Registered February 11th. Capital, £1,000 in £1 shares To take over the business of a mica and general merchant carried on by S. Grout, at Islington, as the London Mica and General Supply Co. The first directors are: S. Grout, 13, St. Helen's Park Road, Hastings; F. A. Smith, 6, Beatrice Road, Walthamstow; W. Beaumont, Firniehill, Blatchington Road, Tunbridge Wells. Registered office: 51, Upper Street, Islington, N.

R. Cranmer Brown, Ltd. (164,229).—Private company. Registered February 18th. Capital, £5,000 in £1 shares. To take over the business of electrical, mechanical and general engineers, contractors, &c., carried on as "T. P. Pollitt & Co., Ltd.," at 9, Wellington Street, Hull. The first directors are: G. H. King, Normont, Kelvinside Gardens, Glasgow; R. C. Brown, 157, Boulevard, Hull. Solicitor: H. Wray, Hull. Registered office: 9, Wellington Street, Hull.

Fletcher Electro Salvage Co., Ltd. (164,150).—Private company. Registered February 17th. Capital, £10,000 in £1 shares. To take over the business of electro depositors of metal carried on by R. J. Fletcher and G. Martin at 3, Penarth Street, Old Kent Road, S.E., as "Fletcher & Martin." The subscribers (each with one share) are: W. C. Petrie, 2, Tudor Street, E.C., manufacturer; R. J. Fletcher, 3, Penarth Street, Old Kent Road, S.E., engineer. The first directors are not named. Registered office: 3, Penarth Street, Old Kent Road, S.E.

Charles Parker (London), Ltd. (164,067).—Private company. Registered February 14th. Capital, £5,000 in £1 shares. To take over the business of manufacturing electrical engineer, magneto specialist, &c., carried on by C. C. Parker at 75, Park Road North, Acton, W. The first directors are: C. C. Parker, 13, Hardwicke Road, Chiswick, W.3, manufacturing electrical engineer (permanent managing director); R. J. Hewett, 12, Hardwicke Road, Chiswick Park, W.3. Secretary: Phyllis M. Heslridge. Solicitors: A. E. Griffiths & Son, 44, Bedford Row, W.C.

Anglo-French Engineering Co., Ltd. (164,246).—Private company. Registered February 19th. Capital, £50,000 in £1 shares. To carry on the business of mechanical, electrical and general engineers, &c. The subscribers (each with one share) are: A. M. Ingledew, 4, Mount Stuart Square, Cardiff, solicitor; A. D. Greatrex, 12, Fenchurch Avenue, E.C.3, steamship manager. The subscribers are to appoint the first directors. Solicitors: Ingledew & Sons, 4, Mount Stuart Square, Cardiff.

Jovel Engine (England), Ltd. (164,268).—Registered February 19th. Capital, £100,000 in £1 shares. To acquire from the Jovel Engine (Parent) Co., Ltd., the benefit within the U.K. and Isle of Man of an existing invention relating to rotary internal-combustion engines, &c. The first directors are: J. A. Vielle, 81, Alleyn Park, S.E.21; R. W. Jodrey, Chocorua, High Road, N.20; E. A. Kite, 31, Warwick Gardens, W.; J. W. R. Bryant, Onslow Court Hotel, S.W.7. Solicitors: E. A. Kite, 2, Dean's Yard, S.W. Registered office: 17, Waterloo Place, S.W.

United Weldings and Electrical Co., Ltd. (164,283).—Private company. Registered February 19th. Capital, £5,000 in £1 shares. To take over the businesses of electrical and oxy-acetylene welders, electrical, mechanical and sanitary engineers, &c., carried on at 116, Chorlton Road, Stretford, as the United Weldings and Electrical Co., and at 3, Carter Street, Greenheys, Manchester, as "Robinson Bros." The subscribers (each with one share) are: Mrs. H. Pearson, 37, Park Street, Chorlton-on-Medlock, Manchester; Lily M. Pearson, 37, Park Street, Chorlton-on-Medlock, Manchester; G. J. Robinson, 80, Shrewsbury Street, Brooks Bar, Manchester, engineer. The first directors are: G. Robinson and C. H. Pearson (managing director). Registered office: 3, Carter Street, Greenheys, Manchester.

Cavan Electric Light and Power Co., Ltd. (4,895).—Private company. Registered in Dublin, February 4th. Capital, £4,000 in £1 shares. To carry on the business indicated by the title. The first directors are: H. McCauley, Farnham Hotel, Cavan, hotel proprietor; A. McCarren, Dromkeen, Cavan, pork merchant; J. F. O'Hanlan, "Anglo Celt," Cavan, journalist; R. Cinnamond, Church Street, Cavan, flesher; J. Cullen, New House, Cavan, wine merchant. Secretary: P. Reilly. Registered office: Main Street, Cavan.

Newtownbarry Electric Light Co., Ltd. (4,873).—Private company. Registered in Dublin, January 9th. Capital, £3,000 in £1 shares. To carry on the business indicated by the title. The subscirbers (each with one share) are: G. T. Lewis, Weston, Newtownbarry, draper; D. Lennon, Main Street, Newtownbarry, general merchant. The first directors are: R. W. Hall-Dare, N. Thackery, D. Lennon, D. E. J. Lawlor and G. Lewis. Secretary: G. Lewis. Registered office: Newtownbarry, Co. Wexford.

Turner & Newall, Ltd. (163,992).—Private company. Registered February 12th. Capital, £3,000,000 in £1 shares (not more than 1,000,000 7 per cent. cumulative preference and the remainder ordinary). Objects: To take over the businesses of (a) Turner Brothers Asbestos Co., Ltd. (incorporated in 1899), (b) the Washington Chemical Co., Ltd. (incorporated in 1893), and (c) of Newhalls Insulation Co., Ltd. (incorporated in 1908), and to carry on the business of manufacturers of and dealers in asbestos, cotton, rubber goods, belting, packings, fire appliances, boiler and pipe coverings, &c. The subscribers (each with one share) are: Sir Samuel Turner, Chaseley, Rochdale; F. S. Newall, Castle Hill, Wylam, Northumberland, chemical manufacturer. The first directors are: Sir Samuel Turner, F. S. Newall, R. Turner, G. S. Newall, C. H. Turner, S. Turner, jun., and H. R. Turner. Solicitor: G. L. Collins, Lower Gates, Rochdale.

Chiswick Ignition Works, Ltd. (164,011).—Private company. Registered February 13th. Capital, £1,000 in £1 shares. To carry on the business of electrical engineers and contractors, &c., and to enter into an agreement with L. H. Lamkin. The subscribers (each with one share) are: L. H. Lamkin, 42, Durham Road, South Ealing, W.5, electrical engineer; F. Hales, 121, Hartham Road, Isleworth, clerk. The first directors are not named. Solicitor: J. A. T. Good, 40, Chancery Lane, W.C.

Electric Fires, Ltd. (164,072).—Private company. Registered February 14th. Capital, £10,000 in 4,000 10 per cent. cumulative preference and 5,900 ordinary shares of £1 each and 2,000 founders' shares of 1s. each. To acquire and turn to account any inventions relating to electrical or other fires, radiators, stoves, &c. Life directors: C. H. Smith, 32, Parliament Hill, N.W., electrical engineer; F. L. Newhouse, The Old Farm House, West Runton, Norfolk, manufacturer. Solicitor: J. N. Watts, 55 and 56, Chancery Lane, W.C.

P.S.C. Co., Ltd. (164,124).—Private company. Registered February 16th. Capital, £3,000 in £1 shares (1,000 cumulative preference). To carry on the business of electrical engineers, agents for commutator bar copper and other requisites for the engineering and allied trades. The subscribers (each with one share) are: Major P. Garton, Inglenook, Gerrards Cross, Bucks; Capt. J. M. Campbell, 37, Queen's Club Gardens, S.W.7. The first directors are: Major P. Garton, Capt. J. M. Campbell, Major A. P. Reed and Major C. Suckling. Registered office: 64, Victoria Street, Westminster, S.W.

Anerley Engineering Works, Ltd. (164,245).—Private company. Registered February 19th. Capital, £500 in £1 shares. To carry on the business of electrical and general engineers and contractors, &c. The subscribers (each with one share) are: E. Harrison, R.A.C. Club, Pall Mall, S.W., engineer; W. Baines, Broad Street House, E.C.2, clerk. The first directors are: E. Harrison, G. Harrison and E. Reyd. Registered office: 97, Anerley Road, S.E.20.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Dartmoor Electric Supply Co., Ltd.—Issue registered January 30th, 1920, of £600 debentures, part of a series of £5,000 already registered.

Hall Pearn & Co., Ltd.—Mortgage on land and premises in Water Street and Back Water Street, Manchester, subject to certain rent charges, registered January 29th, 1920, to secure £3,600. Holder: G. A. T. Jesson, Endsley, Swinton.

Sheerness & District Electric Power & Traction Co., Ltd.—Satisfaction registered January 20th, 1920, to the extent of £200, balance of charge registered February 15th, 1915.

North Wales Power & Traction Co., Ltd.—Particulars filed January 20th, 1920 (by permission of Court) of £250,000 debentures charged on land and hereditaments, and the company's undertaking and property, present and future, including uncalled capital, amount of present issue being £200,000.

Creed & Co., Ltd.—Mortgage on 1, 2 and 3, Addiscombe Road, Croydon, registered January 22nd, 1920, to secure £3,000. Holder: Dr. H. W. Drew, Blatchington, Seaford.

CITY NOTES.

London Electric Supply Corporation, Ltd.

Mr. R. H. Benson presided at the annual meeting on February 20th. He said the present was a crucial moment in the fortunes of the electrical industry; its future as always, was a political question. The speaker gave an interesting review of the pioneering work and the difficulties of the early years of the Deptford undertaking. He said that the value of the pioneering enterprise of the companies could never be overestimated. Municipalities followed, and obtained provisional orders, and in some cases actually competed with the companies. He hoped that at last all the undertakers, whether companies or local authorities, would work together in unison to supply cheap power and plenty of it under the new Act. If we had kept the lead that we had in 1888 the German A.E.G. and the American G.E.C. might have been secondary concerns to-day, or at least Great Britain might have kept abreast and furnished electrical plant to the world as well as to our industries at home. As matters stood, they had several times had to go abroad for their plant; and even to-day British makers could not accept orders, and it was necessary to go to Switzerland. The speaker went on to inquire why Britain lost the lead, and he blamed Parliament. He discussed the position of power supply in the London district. In order to enable all the London companies to pool their resources and experience, a little company called The London Electricity (Joint Committee) 1920, Ltd., had been registered. This was an outcome of the Electricity Supply Bill. At a moment when economy in public finance was imperative, the feeling prevailed that, apart from the improvidence of dismembering existing organisations and scrapping technical and local experience, the Treasury might well be appalled at the prospect of having to find £200,000,000 or more for compulsory purchase of existing plant and development of super-stations up and down the country, especially at the moment when confronted with vast expenditure for housing. In the London district alone the value of existing plant might perhaps be put at £23,000,000, and it was probable that as much again could well be spent in the course of the next ten years. The financial problem of finding the money in such a way as not to be a burden to the State, but a positive source of revenue, and a contribution to the relief of taxation, was, in his opinion, not insoluble. Success depended on two main things: (1) increased output of power and no handicaps; (2) the restoration of the credit of the industry and active support at Westminster instead of harassing conditions. It was the first rule of finance to make the best possible security, to be absorbed by the savings of the public, from the well-to-do down to the humblest.

London Underground Electric Railways.

Lord Ashfield (chairman and managing director) presided at the meeting of the London Electric Railway Co. and the Metropolitan District Railway, on February 19th. At the former, he said he hoped that before long they would be able to sufficiently advance fares to avoid further need for the Government subsidy, and to ensure that the stability of their undertakings should be maintained. The increase in gross receipts was £261,495, but the expenses advanced by £244,308. The purchase of 40 new carriages had been authorised during the year. The cost of this rolling stock, which was similar to that now in use, was £177,700, which was about 240 per cent. more than in 1913. A further £28,000 expenditure on capital account included £28,000 for equipping lifts with landing control. They had not been able to undertake further necessary and substantial improvements because of the present very unsatisfactory results from operation of the undertaking. Speaking of the aggregate results of the five companies, the speaker said that on a total capital of £20,113,420 there was a balance of only £496,387 available for dividend. The subsidy of £566,370 from the Government must some day be wiped away, and increased revenue from passengers must

take the place of that subsidy. In none of the five companies were they able to set aside sufficient to meet depreciation in the value of the rolling stock and equipment, especially when they took into account the enormously enhanced prices. If those allowances were made they had failed to earn sufficient to meet their actual charges without any dividend margin. To have provided enough to pay their expenses and a very modest return of 4 per cent., the public would have had to pay £1,274,629 in increased fares. Lord Ashfield proceeded to give figures to illustrate the advances in costs since 1913. The ratio of working expenses to gross receipts to-day was higher than in 1919, and they were confronted with demands for further increases in wages. In their Bill they were asking for power to charge such fares as would secure a revenue that would maintain the stability of the undertakings.

Speaking at the meeting of the Metropolitan District Railway, Lord Ashfield said that the arrangement between the five companies had been described as an "unholy alliance," and harmful to the public interests. He disagreed. The object of the arrangement was to give temporary assistance to any one of the companies which might meet with a period of adversity. If it were brought to an end it would not prove to anybody's advantage. He could not believe that the Government would go on indefinitely paying a subsidy to secure to the London public a system of transport the costs of which were greater than the revenue received from the passengers. They had on each passenger an actual loss of .07d., and if they had regard to the necessity for making adequate allowance for depreciation and for the increased cost of all equipment, and were to pay 4 per cent. return, the actual loss per passenger during 1919 would have been .38d. per passenger. Since the war labour costs had increased by 173 per cent., coal prices by 182 per cent., and petrol by 280 per cent. Their Bill sought power to increase the maximum charges and to abolish the workman's fares. It should not be the responsibility of the companies to determine whether or not any particular section of the community should be carried at the expense of another section. On the average fare paid by a workman for a single journey last year there was a loss of nearly one halfpenny on the average cost of a journey. Somebody else had to make that difference good.

On February 20th Lord Ashfield presided at the meeting of the City & South London Railway. He said that on that railway they had during the rush hours of traffic practically reached the point of saturation, and substantial improvement in earnings could not be effected through any increase in passengers carried. They had spent during the year £22,300 upon various improvements which formed part of an expenditure of £2,300,000, which though a public need, could not be carried out until the financial position of the undertaking improved. They had powers to raise fares, but were not acting on them, because they were waiting to join in with a general scheme, in the hope that there would be established in London a system of fares more or less upon a uniform basis.

On the same day Lord Ashfield also presided at the meeting of the Central London Railway. He referred to the advancing expenses, and to the new demands, which together led to their seeking Parliamentary powers to increase the maximum charges. He also mentioned the new powers that are being sought to extend the railway from Shepherd's Bush to form a junction with the L. & S.W. Railway.

German Companies.

The Fabrik Isolierter Drahte vorm. Vogel, of Berlin, reports gross profits of 5,030,000 marks for 1918-19, as compared with 4,480,000 marks in the preceding year. After writing off depreciation the net profits amount to 1,780,000 marks, as against 2,720,000 marks, and the dividend is at the rate of 18 per cent., as in 1917-18. It is proposed to increase the share capital by 4,000,000 marks to 11,500,000 marks.

The accounts of the Elektrowerke A.G., of Berlin, whose share and loan capital is held by the Government, have just been issued for the year ended March 31st, 1919. The company's works are built on the Golpa lignite fields, and supply energy to the Imperial nitrogen works at Piesteritz. After meeting general expenses, interest charges, &c., the accounts show gross profits of 2,093,000 marks, which sum has been written off for depreciation, as against 227,000 marks applied to that purpose in 1917-18.

The directors of the Elektrische Licht und Kraft Anlagen, A.G., of Berlin, reporting on the year 1918-19, state that the situation of the company would justify favourable hopes were it not for the fact that the increase on the loan of 8,000,000 marks raised in 1907 was also payable in Swiss francs and redeemable in 1927. The payment of interest in francs had so prejudiced the otherwise satisfactory results for 1918-19 that it was impossible to distribute any dividend, which was also the case in the preceding year.

The report of the Telephonfabrik A.G. vorm. J. Berliner, of Hanover, states that the working results in 1918-19 were unfavourably influenced through the circumstance that the worst period of the crisis took place in the year. The factory at Olmutz was sold, but no reliable information was available concerning the works at Budapesth. After making provision for depreciation the accounts show net profits of 678,000 marks, as compared with 1,194,000 marks in 1917-18, and the dividend is at the rate of 6 per cent., as against 10 per cent. in the previous year.

Fife Tramway, Light & Power Co., Ltd.—Presiding at the annual ordinary meeting, held in Edinburgh, Mr. Wm. Low, LL.D., Q.B.E., submitted figures showing that the profits of the company had steadily increased every year until last year they came to £43,501, compared with £38,652 in the previous year, and £30,577 in 1917. The figures, he said, were very satisfactory, particularly in view of the fact that the company was not assisted by any special war contracts. The power company was making steady progress, the total units sold during the year amounting to 14,891,112, being an increase of 2,600,000 units compared with the previous year. The gross receipts from the sale of electricity amounted to approximately £73,560, as compared with £53,160, but the company did not obtain the full benefit of the increased business owing to costs rising rapidly and the increased charge to the consumer lagging behind the increased costs. There were over 300 applicants on the waiting list, totalling something like 3,000 H.P. The dividend on the ordinary shares is at the rate of 8 per cent. per annum.

City of London Electric Lighting Co., Ltd.—Dividend on the company's preference shares for 1919, 12s. per share, being at the full rate of 6 per cent. per annum; and on the ordinary shares, 20s. per share, being at the rate of 10 per cent. per annum. In addition the directors recommend a bonus of 6s. per ordinary share, being the equivalent of 3 per cent. on account of reductions of dividends during the war, thus restoring the rate of dividend paid for 1914 and 1915 to the pre-war rate of 10 per cent., leaving the reductions in 1916, 1917, and 1918 to be dealt with in the future. This bonus will also be subject to the deduction of income tax. After the payment of the dividends and bonus, less income tax, and providing for other appropriations, about £23,000 remains to be carried forward.

Oxford Electric Co., Ltd.—Net revenue for 1919, including £200 brought forward, £10,065. Debenture and sundry interest £2,126; 5 per cent. dividend on preference capital; 5 per cent., less income tax, on ordinary shares; carried forward £188. The improvement in local commercial conditions consequent upon the resumption of academic life resulted in an increased output during the last quarter of the year. It is expected that the improvement will be maintained. The new business obtained has been quite satisfactory. Capital expenditure during the war has been met almost entirely out of revenue, but in order that profits may be distributed and funds provided for plant and machinery to meet the anticipated increased demand this policy cannot be continued any longer; an issue of capital will therefore be made in the near future.

Torquay Tramways Co., Ltd.—Total profit for 1919 £33,248, against £27,178 for 1918. After deducting debenture interest and sinking funds, &c., the balance is £25,548, plus £2,904 brought forward. To reserve and renewals £10,000; reserve for equalisation of dividends £3,000; 8 per cent. dividend on ordinary shares, £9,600; carried forward, subject to excess profits duty, £5,786. Ten motor omnibuses on order should be delivered shortly. Passengers carried 6,571,441, against 5,729,073 in 1918. Car miles run 561,522, against 578,768 in 1918. Average receipts per car mile 23.71d., against 19.60d. in 1918. Average receipts per passenger, 2.03d., against 1.98d. in 1918. Cost of energy per car mile 2.62d., against 2.24d. in 1918.

Cambridge Electric Supply Co., Ltd.—For 1919 there was a total profit of £8,657 plus £2,552 brought forward. Debenture and other interest absorb £1,866, depreciation fund £2,500, 5 per cent. dividend is to be paid, and £2,382 carried forward. Further money must be raised to provide for mains extensions, &c. The remaining £1 per share on 9,911 shares is to be called up and a further £10,000 is to be raised by the issue of debentures for a period of 10 years, carrying interest at 7½ per cent. per annum. The offer will first be made to the shareholders. Mr. D. Munsey has resigned, after 27 years as a director, owing to advancing years.

Automatic Telephone Manufacturing Co., Ltd.—The company announces that assents having been received from the shareholders for exchange of the requisite number of shares, the directors are completing the transaction mentioned in the company's circular letter dated February 7th, 1920. The option offered to the shareholders to exchange their present shares for shares in the new company will remain open until after the annual general meeting, which will be held as early as possible in March.

Mersey Railway Co.—For 1919 the amount available for payment of interest is £48,113. Interest on new first perpetual debenture stock £26,775. Interest 4 per cent. on 1866, 3 per cent. on 1871, 3 per cent. on 1882/3/5, and 1 per cent on the B debenture stock. Carried forward £60. The company is applying to Parliament for an extension of five years of the period during which the payment of interest on certain of the debenture shocks is contingent on the available net revenue of the company.

Charing Cross, West End & City Electricity Supply Co., Ltd.—Dividend on the ordinary share capital of the West End undertakings for the half-year ended December 31st, 1919, at the rate of 5s. per share, making, with the interim dividend already distributed, 7 per cent. for the year 1919.

Lancashire United Tramways Co.—During 1919 the combined traffic receipts of the operating companies amounted to £194,967, and electrical energy sold and miscellaneous receipts to £22,105; total £217,092; less working expenses, £128,586; cost of generating electrical energy sold, £16,621; general charges, £9,066; rent of leased lines, £5,191; total £159,464, leaving £57,628, to which must be added the dividend on holding in the New St. Helens and District Tramways Co., £3,068, giving a profit on the combined undertakings f £60,696. The receipts show an increase of £35,051. The increase in expenditure amounted to £41,798. The 25 motor coaches mentioned in last year's report are in service. The results were so satisfactory that the directors have decided to extend this side of the undertaking, and have put on order a further 30 vehicles. The interest and dividends received from the operating companies, together with motor coach and sundry receipts, amounted to £37,965. After deducting interest on the prior lien debenture stock and expenses, the full interest of 5 per cent., less tax, will be paid on the second mortgage debenture stock for 1919. £7,219 remaining is carried to depreciation account.

St. James' & Pall Mall Electric Light Co., Ltd.—During 1919 connections were increased from 18,114 KW. to 18,902 KW.; 12,190,175 units were supplied to consumers. Net profits £35,001, plus £4,576 brought forward. After paying 7 per cent. on the preference shares and 12 per cent. on the ordinary, £8,577 is to be carried forward. The report makes reference to the Electricity Supply Bill, in the same terms as in the case of the report of the Westminster Electric Supply Corporation (see ELEC. REV., February 20th). Units generated by steam plant 395,545; purchased 15,860,440=16,255,985; consumed as follows: Private supply, 12,190,175; works, 249,743; batteries, 199,834; transmission and transformation, 2,905,054; distribution, &c., 711,179.

Stock Exchange Notices.—The Committee has ordered the undermentioned to be officially quoted:—

Chili Telephone Co., Ltd.—11,000 shares of £5 each, fully paid.

Electro-Bleach & By-Products, Ltd.—Ordinary shares of 10s. each, fully paid; and 7 per cent. participating preference shares of £1 each, fully paid.

Melbourne Electric Supply Co., Ltd.—Seven per cent. first cumulative preference shares of £1 each.

Smithfield Markets Electric Supply Co., Ltd.—Gross profit for 1919 £6,588, against £470, and the net profit £5,464, against a loss of £1,749 last year. £2,000 to depreciation fund, £400 to debenture stock redemption fund. After deducting the balance at debit of profit and loss account at the end of 1918, the balance is £2,529, out of which 2 per cent. is to be paid on the ordinary shares and £1,329 is carried forward. There has been a gradual improvement in the trading conditions in the Central Markets which is reflected in the larger output of current.

Traction and Power Securities Co., Ltd.—The net revenue for 1919, after deducting expenses, amounted to £30,793, plus £10,033 brought forward. Dividend at the rate of 7s. per share, free of tax, leaving £10,932 to be carried forward. The Clyde Valley Electrical Power Co. has paid dividends aggregating 5 per cent. on its ordinary shares during the year. The ordinary shares are worth more than the price at which they stand in the books of the company.

Liverpool Overhead Railway Co.—Gross revenue receipts for 1919 £172,104; working expenses, including appropriation to reserve, £141,273. Passengers carried 22,440,103, as against 20,880,235 in 1918. Debenture interest £6,755; balance brought forward £6,120; dividend 5 per cent. on the two classes of preference shares, and 3¼ per cent. for the year on the ordinary; £6,015 carried forward.

Chelsea Electricity Supply Co., Ltd.—Dividend on the ordinary shares at the rate of 5 per cent. per annum for the half-year, making 4 per cent. for the year; £16,688 to depreciation; £1,069 written off cost of extinction of founders' shares; £1,500 carried forward.

City of Buenos Ayres Tramways Co., Ltd.—Final dividend of 1s. 3d. per share for 1919, making 5 per cent. for the year, less tax. £6,200 to general amortisation fund; £138 carried forward.

County of London Electric Supply Co., Ltd.—Final dividend at the rate of 11 per cent. per annum on the ordinary shares, making 8 per cent. for the year (increase of 1 per cent. over 1918); £50,000 to depreciation; £45,000 to general reserve; £19,000 to be carried forward.

Company to be Struck off the Register.—The following is to be struck off the Register within three months unless cause is shown to the contrary:—

Faringdon Electric Light & Power Co., Ltd.

Kensington & Knightsbridge Electric Lighting Co., Ltd.—Dividend of 4½ per cent. on ordinary shares for the last half of 1919, making 7 per cent. for the year.

Mather & Platt, Ltd.—Dividend 10 per cent. per annum, free of tax. This is on the increased capital; calculated upon the old capital the rate is equal to 17½ per cent.

Telegraph Construction & Maintenance Co., Ltd.—A further dividend of 7½ per cent. is announced.

Tramways Light & Power Co.—After meeting loan and debenture charges and paying the preference dividend, a dividend at the rate of 7 per cent. per annum is to be paid for the half-year July to December, 1919, on the ordinary stock. To reserve £10,000; carried forward £3,833. Large extensions to plant and mains are now in progress in connection with the power companies, and to meet the cost additional ordinary stock is to be issued.

Direct West India Cable Co., Ltd.—Interim dividend at the rate of 6 per cent. per annum, free of tax, on the ordinary shares, for the past half-year.

Halifax & Bermudas Cable Co., Ltd.—Interim dividend at the rate of 6 per cent. per annum, free of tax, on the ordinary shares, for the past half-year.

South London Electric Supply Corporation, Ltd.—Final dividend at the rate of 8 per cent. per annum for the half-year on the ordinary shares, making 6 per cent. for the year.

Newcastle-upon-Tyne Electric Supply Co.—Total dividend on the ordinary shares for 1919—8 per cent.

Hadfields, Ltd.—Further dividend of 1s. 6d. per share, free of tax, on the ordinary shares.

STOCKS AND SHARES.

TUESDAY EVENING.

STOCK EXCHANGE markets have been overcast, and rather badly, by anticipations of a rise this week in the Bank Rate. As the matter will be decided before these notes are in the hands of readers, it is not much use attempting prophecies. Banks are known to be averse at the present time from lending fresh money on speculative shares—indeed, they do not seem to be eager to lend money at all, the reason being doubtless the fact that trade requirements are regarded as having the first claim upon loanable capital, and with the Government no longer creating credit at the rate which it did during the war, there is some indication of a shortage of capital. This has its influence throughout all the markets of the Stock Exchange. It depresses the gilt-edged stocks, from the War Loan downwards, and the sharp reminder to operators that they must no longer rely upon ready assistance from the banks in financing their commitments has caused a fair amount of selling. The markets with which we deal in these columns are not much affected, except indirectly. The electric lighting dividends are good, and would probably have proved favourable had it not been for the depression which is overhanging the Stock Exchange as a whole.

The Metropolitan Electric Supply dividend, making 6 per cent. for the year against 5 per cent. in 1918, caused the price to stiffen to £4. The Chelsea dividend of 5 per cent., making 4 per cent. for the year, also an increase of 1 per cent., has had no effect upon the quotation, which remains at 3¼. The County dividend, in spite of being better, is regarded as a trifle disappointing, and the price of the shares slipped back to 9½, showing a fall of 5s. Other electric lighting shares are unchanged on the week. Amongst the prior-charge issues, County debenture at 77¾ is ¼ lower, which is due, of course, to the dulness of the Consol market. The manufacturing group is quiet. Interest is taken in the forthcoming new issue by the General Electric Co. Edisons, after being 26s. 3d., reacted to 25s. middle, although there are buyers at this price. India-Rubber shares stiffened to 16, and Siemens are a good market at 30s. 6d. British Insulated dropped back sharply to 2 1-16. Automatic Telephones are about 20s., with little doing in them. A further rise in British Aluminums lifted the price to 37s. middle.

Central London Assented ordinary has fallen another four points, making seven in the course of a fortnight, and this has brought the yield on the stock into nearer line with other Home Railway issues. Business has been done as low as 50 within the last few days. Districts are flat at 18. Underground Income bonds are 2 lower at 76; the £10 shares have receded to 2½.

Mexico Tramways 5 per cent. bonds are down 5 points at 37½. Mexican Light and Power preferred lost 2½ to 32½. These falls are the more disappointing because of fairly substantial rises which have occurred in Mexican Railway stocks just lately. Another department in which activity and strength were noticeable until the money fears arose was that for Argentine Railway and Land descriptions, but the advances failed to spread to the tramway group, where the only movement is ½ rise in Anglo-Argentine Tramways first preference. British Columbia Electric Railway 4½ per cent. debenture is 1½ down. Bombay Tramways continue their amazing flight. In the £10 ordinary shares there was not a solitary deal recorded between one at 101 and the next, the other day, at 145. The preference have put on 30s. at 18½. Whatever the real reason for these extraordinary prices may be, the secret is certainly well preserved. Brazilian Tractions remain at 54, although within the past few days there has been speculative buying on the part of people who usually know what they are about, and who are content to lock up money for a few months, if necessary, in order to take substantial profits in the future.

Marconis dropped nearly 10s. to 3¾, on sales said to come from Italy. (They always say this in the Stock Exchange when Marconis fall back.) A point rally from the worst has made the price 3 13-16. American Marconis remained firm at 29s., but Marines came on offer at 2¾. Great Northern Telegraphs shed another £1. With the rate of exchange moving in favour of the Scandinavian and adjacent countries, the recent flatness of Great Northerns should be checked. Western Telegraphs are 20s. higher at 21¼, this being the only change in their own particular group. The Anglo-Americans are rather lower. Telegraph Constructions lost 10s., there being a little disappointment at the dividend proving to be 7½ per cent., making 10 per cent. for the year, the same as that paid previously. Henley's at 2½ are the turn easier.

Rubber shares are amongst the few that oppose firmness to the prevailing dull tendency in Stock Exchange markets. An impression is current that it will not be long before the price of the raw stuff takes a sharp upward turn, of which, however, there is no indication at present. The Americans are declared to be buying as much as they are able to do without disturbance of the price for the produce. Iron, steel and armament shares are better on persistent rumours of amalgamations, upon a strikingly large scale, amongst various companies in the North and in the Midlands. This consideration has assisted the maintenance of steadiness in engineering shares also.

Before the end of the week it may be that the Yorkshire Electric Power Co. prospectus will be published. The underwriting advance proof states that the company is about to issue £230,000 5½ per cent. redeemable debenture stock at 88, repayable at 100 on December 31st, 1944, at latest, and in addition 40,000 ordinary shares of £10 each at par.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1917.	Dividend 1918.	Price Feb. 24, 1920.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	10	8	6½	—	£8 7 0
Charing Cross Ordinary	4	4	3⅞	—	5 6 8
do. do. do 4½ Pref.	4½	4½	2½	—	8 8 8
Chelsea	5	5	3½	—	6 3 1
City of London	8	8	14	+ ½	7 2 10
do. do. 6 per cent. Pref.	6	6	9⅜	—	8 4 8
County of London	7	7	9½	— ½	8 4 2
do do. 6 per cent. Pref.	6	6	9	—	6 13 4
Kensington Ordinary	7	6	5½	—	5 14 3
London Electric	Nil	Nil	1⅝	—	
do. do. 6 per cent. Pref.	5	6	8½	—	8 11 6
Metropolitan	4	5	4	+ ½	7 10 6
do. 4½ per cent. Pref.	4½	4½	2⅞	—	7 16 6
St. James' and Pall Mall	9	10	6½	—	7 13 10
South London	5	5	3⅝	—	7 12 8
South Metropolitan Pref.	7	7	1	—	7 0 0
Westminster Ordinary	9	8	6	—	8 6 8
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	91½	—1	6 10 3
do. Def.	1½	83/6	20½	— ½	7 6 4
Chile Telephone	8	8	6½	—	*4 13 2
Cuba Sub. Ord.	7	7	10½	—	*6 13 4
Eastern Extension	6	6	20	—	*5 0 0
Eastern Tel. Ord.	8	8	195	—	*5 2 7
Globe Tel. and T. Ord.	7	6	20	—	*4 13 6
do. do. Pref.	6	6	9⅛	—	6 4 8
Great Northern Tel.	22	22	22½	—1	8 17 6
Indo-European	15	15	46½	—	6 13 4
Marconi	20	25	3 13/16	— ⅛	6 11 7
Oriental Telephone Ord.	15	10	2⅞	—	4 16 0
United R. Plate Tel.	8	8	6⅞	—	*4 19 3
West India and Panama	1/8	1/8	1¼	—	5 11 1
Western Telegraph	8	8	21½	+1	*4 13 0
Home Rails.					
Central London Ord. Assented	4	4	51½	—4	7 15 4
Metropolitan	1	1½	28	—	5 8 8
do. District	Nil	Nil	18	— 1	Nil
Underground Electric Ordinary	Nil	Nil	22	+ ⅛	Nil
do. do. "A"	Nil	Nil	7/-	—	Nil
do. do. Income	4	5	76	—2	—
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	87	—	7 14 10
Anglo-Arg. Trams. First Pref.	6½	Nil	2⅞	—	—
do. do. 2nd Pref.	—	—	3½	—	—
do. do. 5 Deb.	5	5	63½	—	7 15 0
Brazil Tractions	—	—	54	—	—
Bombay Electric Pref.	6	6	18½	+1½	3 4 10
British Columbia Elec. Rly. Pfce.	5	5	64	—	7 15 0
do. do. Preferrred	Nil	2½	56xd	—	8 18 6
do. do. Deferred	Nil	Nil	48xd	—	6 10 5
do. do. Deb.	4½	4½	62½	—1½	6 18 3
Mexico Trams 5 per cent. Bonds	Nil	Nil	37½	—5	Nil
do. 6 per cent. Bonds	Nil	Nil	83½	—	Nil
Mexican Light Common	Nil	Nil	22½	—	Nil
do. Pref.	Nil	Nil	32½	—2½	Nil
do. 1st Bonds	Nil	Nil	82½	—	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	3⅜	—	*4 2 9
British Aluminium Ord.	10	10	11½	+ ⅛	5 8 3
British Insulated Ord.	25	12½	2 5/16	— ⅛	6 1 1
Callenders	25	25	9⅜	—	6 9 10
,, 6½ Pref.	6	6½	4⅞	—	6 16 10
Castner-Kellner	25	20	4	—	—
Crompton Ord.	7	10	22/6	—	8 17 10
Edison-Swan, "A"	—	10	1⅜	—	8 0 0
do. do. 5 per cent. Deb.	4	5	70½	—	6 5 9
Electric Construction	10	10	1⅜	—	8 0 0
Gen. Elec. Pref.	6	6½	19/6	—	6 13 4
do. Ord.	10	10	2½	—	*4 9 0
Henley	25	25	2½	— ⅛	5 0 0
do. 4½ Pref.	4½	4½	3⅜	—	6 4 2
India-Rubber	10	10	10	+ ⅛	*6 5 0
Met.-Vickers Pref.	—	—	3⅞	—	5 0 4
Siemens Ord.	—	10	30/6	+6d.	*6 11 2
Telegraph Con.	20	20	20	— ½	*4 2 8

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Tuesday, February 24th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/5	...
a Ammoniac Sal	per ton	£95	...
a Ammonia, Muriate (large crystal)	,,	£75	...
a Bisulphide of Carbon	,,	...	...
a Borax	,,	£42	...
a Copper Sulphate	,,	£51	...
a Potash, Chlorate	per lb.	11d.	...
a ,, Perchlorate	,,	1/3	...
a Shellac	per cwt.	£44	...
a Sulphate of Magnesia	per ton	£15	...
a Sulphur, Sublimed Flowers	,,	£38	...
a ,, Lump	,,	£35	...
a Soda, Chlorate	per lb.	6d.	...
a ,, Crystals	per ton	170/-	...
a Sodium Bichromate, casks	per lb.	...	...
METALS, &c.			
g Babbitt's Metal Ingots	per ton	£118 to £345	...
c Brass (rolled metal 2" to 12" basis)	per lb.	1/4	...
c ,, Tubes (solid drawn)	,,	1/7½ to 1/7¾	...
c ,, Wire, basis	,,	1/4¾	...
c Copper Tubes (solid drawn)	,,	1/10	...
g ,, Bars (best selected)	per ton	£173	£2 inc.
g ,, Sheet	,,	£178	£2 inc.
g ,, Rod	,,	£173	£4 inc.
d ,, (Electrolytic) Bars	,,	£130	£2 dec.
d ,, ,, Sheets	,,	£156	...
d ,, ,, Wire Rods	,,	£145	£2 dec.
d ,, ,, H.C. Wire	per lb.	1/5½	½d. dec.
f Ebonite Rod	,,	3/-	...
f ,, Sheet	,,	2/6	...
n German Silver Wire	,,	3/-	...
h Gutta-percha, fine	,,	13/-	...
h India-rubber, Para fine	,,	2/7	...
i Iron Pig (Cleveland Warrants)	per ton	Nom.	...
l ,, Wire, galv. No. 8, P.O. qual.	,,	£54 10/-	£4 inc.
g Lead, English Pig	,,	£53 5/-	45/- inc.
g Mercury	per bot.	£24 10/- to £25	£2 to £2 10/- inc.
e Mica (in original cases) small	per lb.	6d. to 4/6	...
e ,, ,, ,, medium	,,	5/- to 10/-	...
e ,, ,, ,, large	,,	12/6 to 25/- & up	...
g Phosphor Bronze, plain castings	,,	1/8 to 2/-	...
g ,, ,, rolled bars and rods	,,	2/2 to 2/6	...
g ,, ,, rolled strip & sheet	,,	2/3 to 2/9	...
d Silicium Bronze Wire	per lb.	1/11½	½d. dec.
r Steel, Magnet, in bars	,,	1/8	1d. inc.
g Tin, Block (English)	per ton	£413 to £414	£22 inc.
n ,, Wire, Nos. 1 to 16	per lb.	5/5	2d. inc.
White Anti-friction Metals	per ton	£90 to £345	...

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

A Joint Electricity Authority for Cheshire and Flintshire.—A meeting of local authorities, convened by the Chester Corporation, was held on February 16th, at the Chester Town Hall, to consider a scheme for the formation of an Electricity District and a Joint Electricity Authority for an area extending from Mostyn, in Flintshire, to Tarporley, in Cheshire. The Mayor of Chester presided, and there was a large attendance of delegates. According to the *Observer*, the chairman said he believed the ultimate scheme was to have a group of districts round the North Wales Power Co.'s Station. Mr. E. N. Humphreys, chairman of the Chester Electricity Committee, after explaining the provisions of the Electricity (Supply) Act, said that in July last, Mr. S. E. Britton, electrical engineer to the Chester Corporation, was invited by Sir John Snell to indicate the most suitable area for the North Wales district, and afterwards to convene meetings of the engineers of the various local authorities to discuss the sub-division of the district. Mr. Britton's figures indicated that within the district there was a potential demand of 20,000 H.P., and there was an ample supply of coal and water at hand.

Mr. Britton submitted a map showing the area under consideration, and the larger district embracing the whole of North Wales and part of Cheshire, the latter being the outcome of a suggestion made by Sir John Snell. It was thought that the plant at Queen's Ferry was suitable for the immediate requirements of the district, and the water-power resources of North Wales were far greater than the electrical needs. It was proposed to erect a power station on the Mersey to supply places on both banks, including Birkenhead and Liverpool.

Further consideration of the question was adjourned to a future conference.

An X-ray Victim.—Mr. A. C. Taylor, secretary, dispenser, and radiographer to the Peterborough Infirmary, has fallen a victim to X-ray dermatitis in a virulent form, and is a patient in a private ward of the institution.

Peterborough Infirmary was one of the first hospitals in the country to install Röntgen rays in 1896, and Mr. Taylor both set up and operated the installation.—*The Times.*

THE PROTECTION OF A.C. SYSTEMS WITHOUT THE USE OF SPECIAL CONDUCTORS.

By Major KENELM EDGCUMBE, R.E.(T.), M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

(*Concluded from page* 250.)

In interconnectors and ring mains the normal flow of power may be in either direction. In the ring main, fig. 9, the interconnector between the sub-stations S S_1 and S S_2 cannot be controlled by overload relays since it may carry an overload due to a fault between the generating station and S S_1, for example. Nor can reverse relays be used, since the flow of current may be in either direction under quite normal conditions. A simple solution is, however, possible on the following lines. If the ring were open at R_4, power would, under all conditions of load or faults, flow in a clockwise direction, and overload relays with discriminating time-lags installed at R_1, R_2, and R_3 would afford the desired protection in precisely the same way as with independent feeders. If, on the other hand, the ring were open at R_1 the flow of power would always be in a counter-clockwise direction, and overload relays with discriminating time-lags could be installed at R_4, R_3, and R_2. If, now, the ring be completely closed the following conditions hold good no matter on which section the fault occurs: (1) The fault current will always flow through R_1 and R_4 in an outward direction. (2) The relays R_2 and R_3 should be responsive to a clockwise flow of power alone. (3) Relays R_3 and R_4 should be responsive to a counter-clockwise flow of power alone.

If, therefore, overload relays are installed at R_1 and R_4 with reverse relays at R_2, R_3, R_3, and R_4, they can all be so set as to be inoperative except under fault conditions. In fig. 9 the arrows show the direction of flow to which the various relays should be responsive, and the figures in circles indicate suitable short-circuit time settings on the assumption that a minimum interval of half a second is required between successive relays.

When considering a more extensive system involving a ring main, several sub-stations, and two generating stations, it might be considered that the time settings of the relays are somewhat long, and, although in most cases they might very probably be reduced owing to the discrimination afforded by the current settings, in other cases the times might even have to be increased if the circuit breakers were slow in action. To avoid leaving a heavy short-circuit on the system for so long a time, the arrangement already described whereby, should the voltage fall to a predetermined value (say, 70 per cent. of the normal), the time

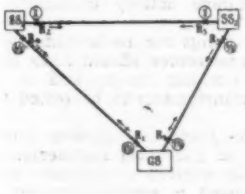


Fig. 9.—Protection of a Ring Composed of Single Feeders.

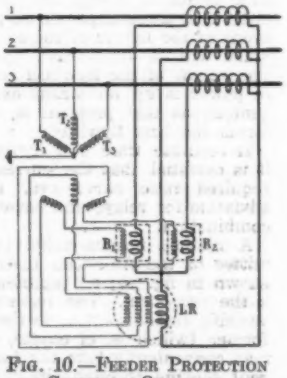


Fig. 10.—Feeder Protection by Combined Overload and Leakage Reverse Relays.

settings are reduced to a lower figure, may usefully be applied to these four relays. By accelerating the time-lags by one second in this way, the maximum possible interval during which a short-circuit could be held would be 1½ seconds.

The reverse relays should be unaffected by a fall of voltage, and be responsive not only to overloads, but also to leakage. Fig. 10 shows such an arrangement. The relays R_1 and R_2 have their current and potential windings connected to phases 1 and 3 respectively, and will consequently respond to overloads or to short-circuits between any of the phases. The leakage relay L R has its current winding in the common return of the current transformers, and is provided with three pressure windings each fed from one of the single-phase potential transformers T_1, T_2, and T_3, the primaries of which are connected in star and earthed. If the insulation of the three mains is perfect, the potential transformers will have equal voltages applied to their primaries, and the resultant flux due to the pressure windings on the leakage relay will be zero. If, however, phase 3, for example, goes to earth, transformer T_3 will have a reduced voltage applied to it, whereas that of T_1 and T_2 will be increased. As a result, the balance will be upset, and there will be a resultant pressure flux in L R in phase with the voltage between line 3 and earth. The leakage current will also be practically in phase with this voltage and will, therefore, cause L R to operate. By this means, relays R_1 and R_2 will deal with overloads whilst relay L R deals with a leakage to earth, and each relay discriminates correctly as regards direction. With such reverse and leakage relays at the sub-station ends of the feeders, overload and leakage relays (fig. 2) may be employed at the generating station ends, but it is often preferable for the sake of uniformity to employ the same relays throughout, and the connections shown in fig. 10 are equally applicable to the outgoing ends.

In many cases the interconnectors forming the ring may be run in parallel, and, in that case, a simple solution is offered by the use of differential relays, fig. 5. A moderate time-lag of, say, ½ sec., is sufficient for all relays. At the generating station ends pure overload relays may be substituted for the differential reverse relays.

In the case of large consumers, the connections amount to what is practically a sub-station, and can be dealt with accordingly. Where the consumer is merely tapped off a feeder his installation should be controlled by overload or, better still, by combined overload and leakage relays with very short time-lags. When a consumer is tapped off a pair of parallel feeders and is able to take power from either feeder at will, reverse relays connected as in fig. 10 afford complete protection if installed at both ends of the section, whether the parallel feeders are independent or form part of a ring main. This arrangement has the further advantage of embodying leakage as well as overload protection.

The protection of generators must be touched upon owing to the effect which it has upon the current capacity of the earthing resistance. Various excellent systems are available, one of the latest being the Merz-Beard, in which the two ends of each generator winding are led through a ring transformer to the secondary of which a relay is connected. The reverse relay, compensated for voltage, forms one of the simplest and most direct methods of generator protection. Most isolating devices, the Merz-Price or Merz-Beard, for example, are only sensitive to an earth or a fault between phases, and will not operate on the occurrence of a short-circuit between turns, or of a mechanical breakdown, or a mistake in paralleling. A reverse relay, on the other hand, will operate under all fault conditions. The fear is sometimes expressed that a heavy cross-current may bring out the generator breaker if controlled by reverse relays. Experience shows, however, that with reasonable current settings and a time-lag of a fraction of a second, such fears are quite groundless. It may be pointed out that although the circulating current between the machines is often considerable, it is very much out of phase with the voltage, and consequently has little tendency to operate the relays. On the other hand, if an actual mistake is made in paralleling, and a generator is connected to the bars, either when dead or when out of phase, the relay will act and prevent damage. In a number of stations, generators are still protected by means of overload relays. Since existing current and potential transformers can in almost all cases be used, the change from overload to reverse-relay control should most certainly be made. Certain patterns of reverse relays can be arranged to operate with an exceptionally heavy forward current accompanied by a fall of pressure. In the case of generator protection this affords a means of isolating the generator in the event of a serious busbar fault. In the author's opinion, it is of even greater importance that the field should be promptly opened than that the generator should be removed from the bars, and the simplicity of having the trip coils of the field and main circuit breakers in series across the relay contacts has much to recommend it.

It is usually possible to connect the neutral points of all the generators to a common bar which is earthed through a resistance. A possible disadvantage of this arrangement is that if the triple harmonic of the wave form is very pronounced a current will circulate between the machines; such circulating currents may be objectionable in their effects upon measuring instruments, &c., and they can be eliminated either by earthing only one generator at a time or by connecting a part of the resistance between each neutral point and the earthing bar, as shown in fig. 11. If the resistances R_1 and R_2 are each made equal to about 15 per cent. of R_3, the triple-frequency current will usually be reduced to perfectly negligible dimensions. Unless a separate resistance is provided for each a switch must be inserted in each earth connection so that dead generators can be disconnected from the earthing bar. If this is not done the dead generators will be "charged" in the event of a fault on the system.

If it is desired to benefit by leakage protection on systems in which the neutral point is not available, those involving delta-wound generators or transformers, for example, it becomes necessary to form an artificial neutral point. The best arrangement is probably a zig-zag connected three-phase

transformer as shown in fig. 12. Each limb carries two similar windings connected in adjacent phases, one end of each being starred and the remaining ends connected, through earthing resistances E R, to the lines. The small figure on the right shows the relative phase relationships of the six windings. Under normal conditions the current taken is merely the magnetising current of the transformer, but should an earth develop, for example, on the lower phase, a voltage is induced in the windings on limbs 1 and 2 (connected between the faulty phase and earth) by the other two coils on those limbs, which are connected to healthy phases. The current flowing to earth through the fault is limited by the earthing resistance to any desired value.

It is of considerable advantage to have a resistance which is a maximum at the outset, subsequently falling in value so as to equalise the current rush to some extent. An earthing resistance possessing these features is the carbon-powder pattern due to Mr. Brazil, which consists of a number of fireclay troughs containing the powder between carbon terminals. The troughs are mounted one above the other and grouped as may be necessary to give the required resistance

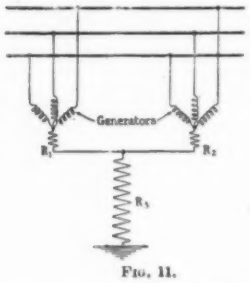


FIG. 11.

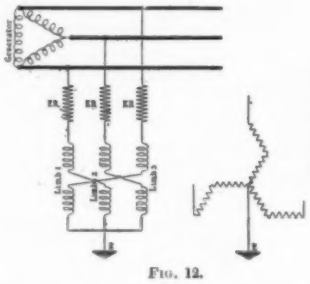


FIG. 12.

FIG. 11.—NEUTRAL POINT EARTHING.
FIG. 12.—DELTA-CONNECTED GENERATOR EARTHED THROUGH ZIG-ZAG CONNECTED TRANSFORMER.

and current-carrying capacity. One of a pair of such resistances, installed at the London and South-Western Railway Co.'s generating station, and each designed to pass 325 amperes at 11,000 volts, after 20 seconds (2,000 K.V.A.), is illustrated in fig. 13.

The flexibility of such resistances will be gathered from fig. 14, in which the curves indicate the growth of current in a single unit when 550, 650, and 750 volts, respectively, are applied to its terminals. The increase of current during a given time is roughly proportional to the square of the applied voltage; and by choosing still lower terminal voltages, resistances can readily be designed capable of being left in circuit for an indefinite period. With such a resistance, a dead earth, even on or near the busbars, will at no time allow the current to exceed that required to operate the relays, so that not only is the shock to the system reduced to a minimum but the breaker opens the circuit at minimum current. The Brazil resistance may be regarded as practically indestructible, in respect of both burnouts and insulation breakdowns, and can be run red hot for an indefinite period, if need be, without danger. It is, moreover, extremely compact. No particular precautions are necessary as regards its installation, and an important feature of the construction lies in the ease with which the units can be regrouped or extended.

In lieu of a resistance in the earth circuit the use of a reactance has been proposed, but such an arrangement suffers from serious disadvantages. The use of a reactance is only permissible when combined with sufficient ohmic resistance to limit the earth current to a small value, that is to say, on systems working with a more or less "floating" neutral. In a modern station running with an earthed neutral the use of a reactance cannot be regarded as a practical proposition.

Whilst it is impossible to lay down any hard and fast rules as regards the current-settings of the relays or the best value for the earthing resistance, since each case must be considered upon its merits, the table below may serve as a guide. In calculating the setting on the lines of column 2, allowance must be made for the distribution of the fault current between parallel feeders, should such exist. In applying the third column it will often be found that the generator protection entails a larger current than the feeders. With differential overload generator protection the current-setting cannot be reduced to a very small value for fear that a want of balance should cause it to operate with a heavy forward current. In this connection the relays might advantageously be given a percentage bias control.

When "straight-through" current transformers are used, as should be the case wherever possible, the value of the current passed by the earthing resistance should not be less than 100 amperes. With an earthing resistance having a negative temperature coefficient the figures given in the last column may be taken as being the initial current. If the resistance has a positive temperature coefficient they must be approximately doubled.

The necessary current for operating the trip coils of the circuit breakers may be derived from any of the following sources: (1) A.C. supplied by a potential transformer. (2) A.C. from a current transformer in the circuit affected. (3) D.C. from a battery or dynamo. (4) D.C. from an A.C.-D.C. machine upon a principle suggested by Mr. F. Ayton.

The first method is to be deprecated unless an entirely independent source of A.C. is available. The application of method 2 is, in point of fact, far from satisfactory. All things considered, this method should only be adopted when no other is possible.

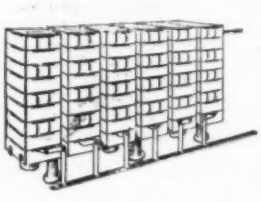


FIG. 13.

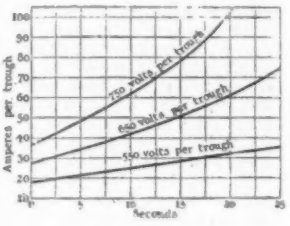


FIG. 14.

FIG. 13.—2,000-KW. 11,000-VOLT BRAZIL EARTHING RESISTANCE.
FIG. 14.—GROWTH OF CURRENT IN BRAZIL EARTHING RESISTANCE.

When method 3 is available, it is by far the best, an accumulator battery being the ideal arrangement. The current derived from an exciter is not to be recommended, since, on the occurrence of a severe fault, the exciters are apt to become unstable.

For sub-stations and other situations where there is no available source of D.C., Mr. F. Ayton, some years ago, suggested to the author a system which might perhaps be called "momentum tripping." The method consists in driving a small D.C. generator from an A.C. motor, the generator serving as a source of energy for actuating the circuit breakers. In order that there might be no possible lack of D.C., even in the event of the failure of the A.C. supply, the set was to be provided with a very heavy flywheel. Calculation shows that the weight of the flywheel required to give an ample reserve of power is by no means excessive. At the same time, ingenious as this proposal is, a storage battery undoubtedly forms the best flywheel.

If accurate time and current settings are to be obtained, it is essential that the current transformer should have the required ratio curve over the working range, and it is advisable for relays and current transformers to be tested in combination.

A method recommended by the Protective Devices Committee of the American Institute of Electrical Engineers, is shown in fig. 15; C T represents the current transformer and R the relay coil. The testing current is applied through a variable resistance V R, to the terminals of the current transformer (which is, of course, dead) at the points P P, which may conveniently take the form of testing sockets. The current flowing through the ammeter A M, is the resultant of that through the relay and the exciting current of the transformer. But the resultant of these two quantities (multiplied by the ratio of the transformer) is equal to the corresponding primary current. Thus it is easy to calculate what current to pass through A M in order to reproduce in the relay R, the current which would flow through it under working conditions for any desired current in the primary.

The current is adjustable by means of the variable resistance V R, and the stop watch W is, preferably, so arranged as to be started by the closing of the testing circuit, and stopped again by the operation of the relay, so that the interval between these two events can be accurately measured.

Form of protection.	Current-setting of relays.	Minimum current in earthing resistance.
Overload as in fig. 2	150% of feeder capacity	150% of capacity of largest feeder
Overload as in fig. 10	150% " "	150% " " "
Differential reverse relay as in fig. 5	70% " "	80% " " "
Differential reverse relay, biased as in fig. 7	20% " "	25% " " "
Leakage relay as in fig. 2	80% of earthing resistance current	20% " " "
Leakage relay as in fig. 10	80% " " "	40% " " "
Merz-Price or Merz-Beard generator protection	50% of generator capacity	70% of capacity of largest generator.
Reverse relay generator protection	25% " "	35% " " "

This method not only deals with the time and current settings of the relay, but also tests the secondary wiring for short-circuits and continuity and the current transformer for a short-circuit or an earth. After testing a current transformer at a heavy overload in this way, care must be taken to demagnetise it thoroughly by gradually reducing the current to zero.

Protection of current transformers against over-pressures is of considerable importance. The current transformer feeding a relay is, from its position at the end of a line, particularly exposed to damage by surges and steep-fronted waves. The current transformer is the first reactance which such a wave meets as it rushes in from a feeder. In order to avoid a breakdown between turns, the use of straight-through current transformers is to be recommended wherever possible, but on the score of accuracy this cannot well be done if the setting of the relay operated by it is less than 100 amperes. Incidentally, this forms an added reason why measuring in-

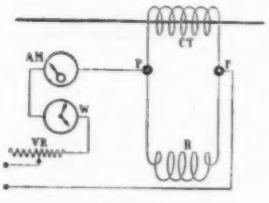


FIG. 15.

FIG. 16.

FIG. 15.—CONNECTIONS FOR THE COMBINED TESTING OF CURRENT TRANSFORMER AND RELAY.
FIG. 16.—CURRENT TRANSFORMER PROTECTED AGAINST DAMAGE BY OVER-PRESSURES.

struments should not be fed from the same current transformers as the relays, since the former have to be accurate from the lower limit of their range upwards, whereas, with the latter, accuracy of ratio is usually immaterially below, say, half load.

Where multi-turn current transformers have to be employed on lines liable to surges—and few can be considered immune—it is advisable to bridge the primary winding by a non-inductive resistance which forms a by-pass for the surge, and thereby relieves the strain between the turns of the winding. Fig. 16 shows such a resistance as applied to a tank-type current transformer. So long as the value of the resistance is adapted to the impedance of the current transformer the accuracy of the latter is not appreciably affected.

CONCLUSIONS.

The points which the author has endeavoured to make may be summarised as follows:—

1. In any scheme of protection, continuity of supply should be the first consideration, simplicity the second, and adaptability the third.

2. The neutral points of generators and step-up or step-down transformers should be earthed through a resistance having a negative temperature coefficient.

3. When the neutral point is not available the system can be earthed through a zig-zag transformer and an earthing resistance.

4. In a large number of cases special conductors are out of the question, and any and every part of a distribution system can be protected by overload, reverse or leakage relays in accordance with one or other of three alternative methods as follows: (*a*) For independent single feeders, combined overload and leakage protection with graded inverse time-lags (fig. 2). (*b*) For independent parallel feeders, differential reverse relays with short inverse time-lags (fig. 5). (*c*) A single interconnector between two generating stations can be treated as an independent feeder and protected at each end as in (*a*) above. (*d*) For a ring main consisting of single feeders, combined overload and leakage reverse relays with graded inverse time-lags (fig. 10). (*e*) For interconnectors or ring mains composed of parallel feeders, differential reverse relays with short inverse time-lags (fig. 5). (*f*) Any of the above arrangements can be supplemented by minimum voltage protection at the sub-stations where this seems advisable. (*g*) For the protection of generators running in parallel, voltage compensated reverse relays with short time-lags are effective against all faults, and may be relied upon not to act prematurely.

5. All overload relays must have similar time/current curves, with a definite minimum, independent of the overload.

6. All reverse relays must be compensated for a fall of voltage down to 2 or 3 per cent., and may, in some cases, be required to operate with a heavy current in either direction at zero voltage.

7. Current transformers should be of the straight-through type whenever possible, and should otherwise be protected by a non-inductive shunt of ample current-carrying capacity and specially adjusted to the transformer characteristics.

CONFERENCE OF MANUFACTURERS.

(*Concluded from page 254.*)

PRICES AND PROFITS.

The final resolution dealt with on Feb. 10th related to prices and profits, the proposer being Mr. Max Muspratt, of Liverpool, and the seconder Sir Algernon F. Firth, Bart. The view expressed in both speeches was that economic conditions must really be left to right the position, and that artificial aids would not improve the situation. The resolution, upon which there was no discussion, was:—

"That this conference considers that the present high prices of manufactured goods are inevitable so long as demand throughout the world remains so greatly in excess of supply.

"No attempt to fix prices or restrict profits by Government action can improve the situation from the national point of view. If prices are fixed below the world price the home market will be depleted unless export is restricted, while any attempt to restrict export will raise the price of the goods which the country must import from abroad, for it can only pay for these goods with the value of the goods which it exports.

"The only remedy is for the Government to remove as far as possible all restrictions upon trade, and to encourage the greatest possible development of production and distribution through normal channels. High profits are at once the fund from which plant and working capital may be increased, as also the greatest incentive to development, and development of production is the only sure way of reducing prices.

"The conference realises that the conditions now existing are without precedent, and that the peak of prices is probably higher than ever before in the world's history. This condition must inevitably be followed by a reaction, with the probable consequence of depressed trade, an aspect of the question which should receive the most serious consideration of all manufacturers and producers.

"Meanwhile, in order that the public may be enlightened as to the circumstances prevailing in other countries, this conference strongly recommends the Government to publish monthly comparative statements, showing the current prices of the chief commodities in the principal countries of the world; these prices being converted into English currency values at parity, in order to show clearly the relative burdens borne by individual consumers in this country and in other countries."

The first resolution dealt with on the second day (Feb. 11th) was on nationalisation.

SIR ADAM NIMMO, who was a member of the Sankey Coal Commission, and issued a minority report, warned his hearers that the move for nationalisation of mines was the first step in a general labour policy for the nationalisation of all the leading industries of the nation, and he urged employers in other industries not to stand aside and watch the result of this particular fight. They should all come to the assistance of the mining industry and fight the movement now, as if it were successful in the case of the mines it would be carried on in relation to other industries, such as railways, shipping, banking, insurance, and so on. Nobody could understand the dictum of Mr. Justice Sankey that the system of private control had broken down, and that it stood condemned. That statement was unsupported by any argument, and it should not be accepted until the whole of the evidence upon which it was based had been investigated. His own contention was that nothing in the history of the country could be pointed to as indicating that the system of private control had broken down. It was the business of the Government to govern, and to look after the general interests and welfare of the people. State conduct of business was not new in the history of the world, but they could not point to a single instance in which it had been successful. The intervention of the State in the coal industry had led to a more or less general paralysis of the industry, and the owners had been prevented from carrying out developments which were essential to the progress of the industry and the other industries of the country. He hoped, therefore, that there would be a plain declaration by the Government that it would not nationalise the mines, because if that were done he believed it would pave the way for the men to arrange with the employers some system whereby they could work the mines in the most efficient manner possiole.

MR. ARTHUR POLLEN, managing director of Linotype, Ltd., seconded the resolution.

MR. G. W. MULLENS (Cold Rolled Brass and Copper Association) moved the following addition to the resolution:—

But the conference recognises the importance of educating our workers and of associating them with us in the responsibilities of industry and will welcome every well thought out experiment to this end, such experiments to be made direct between employers and employed, and may be in single shops or collectively in trades.

He moved this, he said, in order to make some constructive proposal instead of merely saying "No" to the nationalisation proposal. It would go a long way towards removing the suspicion of the workers if the employers showed that in the place of nationalisation they were prepared to co-operate with labour in the manner suggested.

Mr. Philip H. Lockhart (W. & A. Bates & Co.) seconded the amendment, and recommended employers to establish more works committees under the Whitley scheme. If they did that, they would be surprised at the change in the spirit of their workpeople.

Mr. Bremner (British Engineers' Association) said that the conference displayed the remarkable degree of apathy which existed among employers as compared with the interest, enthusiasm, and energy displayed by labour. Manufacturers would have to co-ordinate their efforts under well equipped and highly skilled leadership. He himself had been greatly disappointed at the results of his own efforts at organisation in this direction, but there was no hope for them unless they did unite and work together.

Lord Gainford suggested that State ownership as well as State control should be embodied in the resolution. The miners were as opposed to State management as the owners, but they wanted State ownership. Then their plans were to manage the mines largely themselves. The Pit Committees which it was proposed to set up had 87½ per cent. of the representation as miners.

After a little discussion it was agreed to adopt Mr. Mullens's addition as a separate resolution.

The resolution on nationalisation was then carried in the following terms:—

That this Conference pledges itself to oppose in the national interest any attempt to impose State ownership or management on any branch of industry.

Transport.

Mr. Marshall Stevens proposed a resolution dealing with transport. He said that since the resolution had been drafted the Ministry of Transport had sent a letter to the Federation stating that it was proposed to set up an inquiry into the details of railway rates, both passenger and goods. That was what the traders of the country had been asking for for years, because it could be shown that merchandise traffic, as such, did not show a loss. The railway accounts did not distinguish between goods and passenger traffic, but their goods rates even before the recent interim revision were the highest in the world, and the Committee of the Federation which had been going into this matter had evidence which would enable them to answer the 15 questions in the letter from the Ministry, almost at once. The matter would be gone into very carefully and a reply forwarded within the time stated, viz., March 15th.

Mr. T. Major (British Empire Producers' Association) seconded the resolution.

Mr. F. Ley (National Association of Iron and Steel Manufacturers) emphasised the importance of the portions of the resolution referring to delays, and instanced cases on the north-east coast where works had to be shut down for considerable periods because of the accumulation of finished steel which could not be transported. There were thousands of tons lying there, and in addition there was the loss entailed by reduced production and loss of wages to the workpeople who had to stand off. He moved an amendment urging upon the Ministry of Transport the establishment of a three-shift day, including Sundays, as a means of reducing the arrears which had accumulated.

This amendment was carried as a separate resolution.

The original resolution was then put and carried in the following form:—

1. That this Conference views with the gravest possible concern the delay in re-establishing efficient working of the railways, and considers that this is largely due to over-centralisation of control in the Ministry of Transport, and the uncertainty as to the future position of the railways.

The Conference considers that it is of the greatest importance that the railways should not be permanently subject to bureaucratic or political control, and urges the Government to reappoint as quickly as possible the Select Committee of 1918 to consider the whole question of the future of the railways.

2. While not wishing to question the necessity of making some increase in railway rates, this Conference desires to protest against the action of the Government in fixing the new increases upon an estimated deficit which circumstances apparently make it impossible to justify by definite figures. This policy has resulted in throwing upon the rates during this critical period, when the cost of living and consequent social instability is increasing almost daily, an estimated deficit which is probably to a large extent due to abnormal and transitory conditions.

This Conference considers that the deficit on the working during the reconstruction period should have been placed to a suspense account; the Government should then have made a careful inquiry into the whole question, giving due consideration to the conditions and requirements of different classes of traffic, and fixed the increase of rates on this basis, with an addition to make good the estimated deficit over a period of years.

3. That this Conference welcomes the decision of the Ministry to proceed immediately with the general revision of rates which has been recommended by the Rates Advisory Council and the invitation which has been extended to the trade organisations affected to submit their views upon the questions involved.

Fuel.

Lord Gainford moved a resolution in connection with the question of fuel supply. This was considerably modified during the course of the discussion, and we give it as it was finally passed:—

That this Conference views with alarm the chaotic condition into which the Government has allowed the coal policy of the country to drift. This has arrested normal development and has most seriously impeded the resettlement of the industry. As a further consequence, the distribution and quality of coal for industry is unsatisfactory. The Conference is convinced that the distribution of the coal required for industry ought to be allowed to follow its natural course in satisfaction of industrial requirements.

In the course of his speech, Lord Gainford complained of the inconvenience which the coal trade had suffered by the imposition of the 6s. increase followed by the 10s. reduction on household fuel and the further increase in the price of household coal. Another serious difficulty had been the increase granted by the Government to the minimum wage, the result being that in many cases the miners were quite content with the minimum wage, and made no very great attempt to send to the surface a quantity of coal in proper relationship to their capacity. Whilst the number of men employed in mines was increasing, the output per man was decreasing, and viewing the whole of the position, he believed that if all Government control was taken off the industry the employers and the men would be able to devise a plan of working which would work amicably. If this were done, he foresaw the possibility of some home industries being short of coal on account of the temptation of the high export price to send coal out of the country instead of supplying it here, but to prevent that he would limit the amount of coal which could be exported. It was, however, impossible to carry on an industry for long under artificial restrictions as to price. The Central Committee of the Mining Association had come to the decision that it was right and proper for a central body to be appointed to consist of owners, miners and representatives of the consuming public in order to place the industry on a sound economic basis.

Mr. W. T. Layton (Federation of Iron and Steel Manufacturers), who seconded the resolution, spoke of the difficulties which the iron and steel trade are experiencing in the matter of fuel, and the manner in which the output of steel is being hampered by the shortage, which difficulties had been accentuated by transport difficulties.

As already stated, the resolution was finally agreed to as set out above.

The following resolutions were also agreed to, but the speeches of the movers and seconders brought out no new facts. We therefore give the terms of the resolutions only:—

Education.

1. That as industrial progress depends on the development of education among all classes of workers, both manual and mental, this Conference welcomes the awakened national interest in the subject, and urges manufacturers to give their practical assistance in the working of the Fisher Act. The Conference, however, regrets that one of the most important requirements of a satisfactory educational scheme, namely, the adequate remuneration of the teaching profession, has not yet been fulfilled.

2. That this Conference fully approves of the efforts being made to introduce university men, and men of similar educational training, into industry.

Research.

That this Conference appreciates the work of the Department of Scientific and Industrial Research in stimulating the work of industrial research, and strongly urges all manufacturers, either individually or collectively by trades, to organise and maintain research facilities.

Housing.

That this Conference welcomes the assistance which is offered to public utility societies by the Housing (Additional Powers) Act, 1919, and urges all manufacturers and producers to consider whether they cannot take advantage of the provisions of the Act, in order to contribute to the solution of this pressing problem.

GAS v. ELECTRICITY.

As reported in the Electrical Review of February 20th, the members of the South Midland Centre of the Institution of Electrical Engineers and the Midland Junior Gas Association took part in a debate upon "The Uses of Gas and Electricity for Heating and Power" at Birmingham University on February 5th.

Dr. E. M. Smith, chief chemist of the Birmingham Gas Department, opening the debate by discussing the utilisation of fuel for the generation of power, said neither industry could, with justice, suggest that there was not room for the other. Nor could either industry suggest that the one or the other should not endeavour to improve its efficiency. In a comparison between the two industries as to the general application of a particular form of power, the questions which presented themselves might be placed in three divisions:—(1) A prospective consumer might ask which was the cheaper form of power; (2) which was the more economical form and which, if extended, would give the greater national return; and (3) which particular form of power was best suited to his needs, taking everything into consideration. Sir Dugald Clerk and others, in a recent report, stated that at present the gas works of the United Kingdom used 20 million tons of coal per annum, producing town gas, tar, and other by-products, with a thermal efficiency of from 70 to 80 per cent. Even regarding gas as the only useful product the consumer received as inflammable gas, at least 50 per cent. of the heat value of the coal. The electric generating stations in the United Kingdom delivered 7.6 per cent.—the actual power lost accounting for 92 per cent. of the total heat. At the best electric generating stations the loss was 88 per cent. Electricians promised for future super-stations a delivery of 17.6 per cent., a loss of 82.4. At present the best existing gas

practice delivered over 60 per cent. of the heat in the coal used to produce it. In the near future the thermal loss should be reduced to 25 per cent. Except where temperatures above 1,700 deg. were required electricity was extremely wasteful. As to lighting and power production electricity promised results which compared more favourably with gas; but even in this domain the highest over-all efficiency attained by electricity fell behind. Again, the prospective economies in the production of gas, and the advantageous use of the incandescent mantle rendered any point as to monopoly claims, so far as electricity was concerned, quite unjustifiable. There were many considerations, if a just estimate were to be made of the part which gas played in the national economy, and apart from the uses of gas for heating, lighting, and power purposes the question of by-products, which were produced in large quantities, must be considered. The ammonia industry depended largely upon the gas industry, while from gas residuals, fertilisers, high explosives, &c., were obtained, and the indications were that there would be further developments in that direction. By-products from tar included dyes, medicine, scents, &c., as well as fuel oil. It was the practice of progressive gas undertakings to wash the power gas for benzol for motor spirit, and at one of the Birmingham gas works a thousand gallons of benzol were produced. It now appeared that experiments for the production of alcohol from coal gas would be successful, and if that anticipation were realised, it would be obtained in equal quantities to the present quantities of benzol. Lastly, there was the production of cyanide, which was of importance in the work of the colonial gold mines. Dr. Smith, in conclusion, expressed the hope that the debate would have the effect of enabling them better to appreciate the necessity of both industries, from a national point of view, and instructing them upon some matters of value to both.

The speaker for electricity, Mr. F. Forrest, M.I.E.E. (chief assistant engineer, Birmingham Corporation Electric Supply Department), said that in considering any national power supply undertaking the power must be such that it could be economically generated by any of the natural power resources of the country—coal deposits, oil wells, waterfalls, &c. Gas could be generated only from carbonaceous material, and therefore could only make use of the resource they were most anxious to conserve. Electricity, on the other hand, could be economically generated from any of the sources mentioned, or it could be produced by means of waste heat from other manufacturing processes. The Water Power Resources Committee, in a recent report upon the water power available in the Scottish Highlands, after nine sources of power had been investigated, calculated the yield at 183,500 E.H.P., working continuously with a 100 per cent. load factor corresponding to an output of 1,200,000,000 B.O.T. units per year, or more than double the present output of all the power stations in Scotland. Moreover, Sir Dugald Clerk had stated that if this country's available water power were used for power purposes, it would be followed by a saving of 26 million tons of coal per annum, and enable them to increase their ten million H.P. of industrial load to 13 million H.P. without any increase in fuel consumption. Referring to the steam turbine, the speaker said the consumption running light was only about 8 or 10 per cent. of the full load consumption, whereas in the case of the gas engine the light load consumption was about 30 per cent. of the full load consumption. The initial capital cost of turbine plant amounted to only 70 per cent. of the capital cost of gas engine plant. Mr. Forrest stated that the cost of labour necessary to run a large gas engine plant was much greater than that required to run a turbine plant of equal output, which was absolutely constant. Even in isolated cases where it could be shown by calculation that the cost of generating power by gas engines would be less than if turbines were used, experienced engineers had adopted the turbine for its reliability and general convenience. Attention was being given by electrical engineers to the question of gas firing of boilers. They wished to combine the efficiency, reliability, and convenience of the steam turbine with some form of by-product recovery plant if it could be shown that such a combination was sound.

The next phase of the debate was in relation to the industrial application of the two agents, and the case for gas was presented by Dr. C. M. Walter, of the Industrial Research Laboratory, Birmingham Gas Department. He pointed out that the industrial applications of gas and electricity covered such a huge field that, when comparing the two, one was bound to find that for certain industrial operations one or other was particularly adapted for the work. As examples, they might take the welding of small components and sheet metals, for which electricity was especially adapted; and again, the carburising or reheating of large masses of metal where gas must inevitably be the heating agent. Comparing the costs of the two agents, the speaker said that prior to the war the cost of carrying out work in the electric furnace was at least three times as great as in the case of the gas furnace. Gas furnaces for forging and reheating were now designed on recuperative principles with efficiencies as high as 40 per cent.; the electric furnace remained at its old figure of 50 or 60 per cent. The electric furnace would be confined to the more specialised industries, and to small work which was carried out in laboratories.

Mr. F. J. Moffett, consulting electrical engineer, Birmingham, said that to utilise gas for heating, combustion must take place, and only a fraction of the total heat units in the gas was utilised in heating the charge, the remainder of the heat being carried off by the waste gases and excess air. The efficiency of conversion of electrical energy to heat was practically 100 per cent. When heat was produced by combustion there were usually certain impurities present, such as sulphur and carbon, which were liable to be absorbed by the charge, but in the conversion of electric into heat energy no such impurities were present. To compare a gas heated furnace, therefore, on the same basis with an electric furnace, the former should be designed so that the charge was enclosed in a container. The efficiency of a furnace might be defined as the ratio of the heat units usefully employed to the total heat units in the gas used or in the electrical energy supplied. In an electric furnace the losses could be confined very closely to those due to radiation and conduction, and the average working efficiency could be taken at 75 per cent., while that of a gas furnace was 25 per cent. A valuable feature of the electric furnace was the high temperature attainable. The temperature of the arc was about 3,500 deg C., and the limit in practice was the fusing point of the refractories lining the shell. For certain processes a temperature higher than could be reached by the combustion of fuel was required, and the electric furnace was the only solution. With a fuel heated furnace there was a point at which the components of the gas ceased to combine with the oxygen of the air. The highest temperature in a combustion furnace without recuperation was from 1,500 deg. C. to 1,800 deg. C. The electric furnace was particularly suitable for steel melting and refining, for the reduction of iron ore, and for the preparation of elements like phosphorus and aluminium, in which electrolytic action was necessary. He protested against the distorted view of some gas and electrical engineers that their interests were always opposed. There was, on the contrary, plenty of room for co-operation.

The case for gas domestic appliances was submitted by Mr. R. J. Rogers (fittings superintendent, Birmingham Gas Department). His contention was that for cooking and heating in such appliances, gas was the more efficient and economical. The thermal value obtained from one unit of electrical energy on complete conversion to heat was 3,420 B.TH.U., while taking the basis of one cubic foot of gas as giving 470 B.TH.U., 7.27 cu. ft. of gas was required to provide the same as one unit of electricity. Taking Birmingham prices, with electricity at 2.66d. per unit and gas at 3s. 10d. per 1,000 cu. ft., the cost of gas would be .33d., as against 2.66d. for electricity. Electrical water heaters gave 90 per cent. efficiency, and the gas-heated apparatus in the form of a geyser, 85 per cent. efficiency, though some geysers gave higher efficiencies. The cost by electrical appliances was 7¼ times more than with gas. Regarding room warming, if the efficiency of electric heaters was conceded to be 100 per cent., it would be seen that electric heating cost six times as much as gas fires, giving 75 per cent. efficiency. In addition to the excessive cost of fuel, the drawbacks to electricity for cooking were: High cost of installation, high and uncertain cost of upkeep, difficulty of management, lack of facilities for hot-plate work, and slowness of operation. At the Southampton docks, national kitchens were provided, and in addition to the existing gas appliances electric cooking stoves and tea urns were fitted; but experience showed that the latter were scarcely ever used.

The case for electricity was put forward by Mr. N. B. Rosher, O.B.E., M.I.E.E., consulting engineer, Birmingham, who said that lifts, vacuum cleaners, boot and knife cleaning machines, sewing machines, and fans could only be efficiently worked by electricity, and last year 600,000 electric vacuum cleaners were sold in America. If gas were used economically, *i.e.*, with only the bare minimum of air required for combustion, the temperature would be about 3,500 deg. F. To avoid that, the temperature (and therefore the efficiency) had to be reduced by the admission of ten times the amount of air actually necessary for combustion. In a lecture given by an independent authority (Mr. A. H. Barker) at University College, London, the efficiencies of various ovens were given as follows: Coal-fired oven, 3 per cent.; gas cooker, 11 per cent.; electric cooker, 21 per cent. Mr. Rosher considered the more modest figure of 19 per cent. to be more correct for the electric cooker. A unit of electricity, no matter how or where it was generated, contained 3,410 heat units, whereas 1,000 cu. ft. of gas might contain anything from 450 to 650 heat units. The loss in cooking, according to Mr. Barker, was as follows: Totally enclosed oven (electric), loss equals 10 per cent.; ventilated oven (coal), loss equals 15 per cent.; freely ventilated oven (gas), loss 20 per cent.

Mr. R. G. Marsh (fittings engineer, Birmingham Gas Department) spoke upon the transmission and distribution of power from the gas point of view, and said that at the present price ruling in Birmingham gas was cheaper than electricity. If they took the instance of a manufacturer requiring 50 H.P. to drive his workshops, and assumed a load factor of 50 per cent., allowing 26 cu. ft. per H.P.-hour, during a year of 3,000 hours with gas at 3s. 6d. per 1,000 cu. ft., his annual gas bill would be £341. Allowing for costs of attendance a further £50 per annum, and for oil, spares, &c., a further £50, and for interest and depreciation 10 per cent. on, say, £600, the cost of the engine, another £60, his total bill would come to £501. For the same power the cost of energy alone at 2½d. per unit for a 50-H.P. motor would be

£780; that was allowing nothing for attendance, oil, depreciation, or interest in respect of the motor.

Mr. W. W. Wood, A.M.I.E.E. (General Electric Co., Birmingham), speaking on behalf of electricity, pointed out that energy could be efficiently and conveniently transmitted over practically any distance. An American company had during the last five years transmitted 1,600 million H.P.-hours a distance of 240 miles, with an average efficiency of 87½ per cent. The load factor was 50 per cent., so that the maximum load was well over 70,000 H.P. The extensive use of the electric motor was not on account of efficiency alone, but depended greatly on its convenience.

There was a brief discussion during which the chairman (Mr. E. C. R. Marks, M.I.M.E.) expressed the view that it was most important that municipal gas and electricity undertakings should be under the administration of a joint committee.

The debate was wound up by Dr. C. C. Garrard, M.I.E.E. (General Electric Co.), and Dr. Smith (Gas Department), and the proceedings concluded with a vote of thanks to the chairman.

LEGAL.

Direct U.S. Cable Co., Ltd., *v.* Western Union Telegraph Co., Ltd.

In the Chancery Division, Mr. Justice Peterson on February 16th continued the hearing of this action, adjourned from November last for the production of evidence and documents from America, concerning the dispute between the two companies in relation to a 99 years' lease of a trans-Atlantic cable at an annual rental of about £60,000. The plaintiffs (an English company) under the covenants of the lease of their cables to the defendant company undertook to repair the lines and maintain through communication, power being reserved to the lessees to determine in the event of 18 months' continuous interruption.

Mr. Mangham, K.C. (for the defendant company), on the hearing being resumed, said that he proposed to take the evidence from America as to the breaks in the cable in shallow water in America, as he understood that some point was going to be made of the new repairs of the shallow water section on the cable on the United States side. He proposed to produce evidence as to breaks which had occurred between Rye Reach and Halifax, but inconvenience and complications arose from the fact that he did not know what was the real issue between the parties.

Mr. Romer, K.C. for the plaintiffs, said that his contention was that the plaintiffs were stopped from relying upon the smaller breaks in the cable. He complained that the other side had failed to make repairs which his company were led to believe they would do. It was not until after the action had been started that they became aware of the fact that certain breaks had not been repaired.

Mr. Patrick William Reib, superintendent in charge of the station at Rye Beach, in the State of New Hampshire, was called, and in his examination by Mr. Mangham said that in the course of his duties he became aware of the loss of insulation in the Halifax cable due to breaks or faults. One of the breaks complained of, he said, occurred about 428 nautical miles from Rye Beach on January 7th, 1917, and another occurred on August 8th, 1917, close to Halifax. These were both repaired shortly afterwards. On December 2nd of that year there was an interruption, which was repaired on the 11th and communication was re-established. As to the first fault, they were able to work through, but with great difficulty, but on January 7th, 1918, there was complete interruption, and he localised it at about 325 nautical miles from Rye Beach. Then on the 9th another break occurred 93 miles from Rye Beach, and from that date to July 29th, 1919, the cable could not be used. Between January 5th, 1918, and July 29th, 1919, it was not possible to use the cable between Halifax and Rye Beach.

Witness then gave details of the repairs carried out from time to time by the company's ship.

In cross-examination, witness said as to the breaks in the Bay Robert section the repairs were carried out by a French cable ship, but with that exception they were always repaired by his company's ships. The French ship, while repairing other cables, broke the defendants' cable by mistake and repaired it. The breaks in the shallow water cables were frequently caused by dredgers and other ships fouling them. A great many breaks in Halifax Harbour had occurred from this cause.

Mr. Joseph Brown, superintendent in charge of the Halifax cable station, also gave evidence as to the condition of the cables between Rye Beach and Halifax and Halifax and Bay Robert and the breaks spoken of by the previous witness, as well as to the time occupied in carrying out the repairs.

Mr. Reginald Carlton, president of the Western Union Telegraph Co., of New York, gave evidence as to the general organisation of the Western Union Co. He said that the superintendent reported directly to him, and amongst the most important matters reported to him were the repairs of cables, the expenditure in relation to which was very heavy. There were three repairing ships leased to the company.

After describing the company's system of cables and the details of the repairs done by the ships in the control of the company, the witness said that there were seven breaks in 18 months, the whole of which were repaired by two of the company's ships. During 1918 they had no ship to repair in the Halifax Rye Beach section without sacrificing other much more important work.

The cross-examination of the witness by Mr. Patrick Hastings, K.C., was directed to showing that the Western Union were desirous of leaving an interruption to continue for 18 months so that they might be in a position to put an end to the contract.

The hearing was adjourned.

On the case being resumed, on February 17th, further evidence from America relating to breaks and the action of the defendants in relation to the repairs was given, and the further hearing was adjourned until February 23rd.

Damages for Tramway Passenger at Dublin.

In the High Court of Ireland, Dublin, last week, before Lord Justice Dodd and a special jury, M. McNamara, schoolboy, sued by his father, the Dublin United (Electric) Tramways Co. to recover £1,000 damages for personal injuries. Judgment was given for £875, with costs, but a stay of execution was granted to enable the King's Bench Division to pronounce on the verdict, a condition being that meantime the company should pay £5 a week to the mother of the plaintiff towards his maintenance.

The case for the plaintiff was that as he was riding on the upper deck of a tramcar the trolley pole left the wire, struck him on the head, and inflicted injuries which seriously affected his health, inflammation of the brain developing.

Evidence was given by the conductor and the driver of the car and also by the driver of a passing car, that the trolley did not strike the boy at all. The conductor stated that shortly after the car had stopped, as a consequence of the trolley leaving the wire, he went on the top of the car to collect fares. He saw the boy sitting there with his hands to his head. The conductor asked him what was the matter, and he made no reply. When the boy was getting off later on he made no complaint. He believed that the trolley did not strike the boy at all. The driver of the passing tramcar, who saw the trolley leave the wire, said that the trolley did not fall straight down, but swayed round in a lateral direction. It was shown that the car was only going at the rate of 5 or 6 miles an hour.

Mr. G. M. Harris, general manager of the tramway system, told the Court that the car on which the accident occurred was properly equipped, and that it was constantly in use since the accident, as before it. No repairs had since been done to it. A trolley on leaving the wire invariably jumped upwards. The suggestion made on the previous day that the tramway tracks were defective was nonsense. Even if they were, it could have no effect on the trolley. Trolleys occasionally left the wires everywhere, and sometimes no explanation could be given of it, and so far as electrical science had gone, no means had yet been devised to prevent it. In cross-examination, Mr. Harris's attention was drawn to the fact that on the Dublin and Lucan Electric Tramway a steel bar had been placed along the top of the car to protect passengers from being struck by the trolley. Mr. Harris said that he was aware of that. The Dublin tramcars had no such arrangement, and he did not see the slightest use in it.

Mr. Grosart, manager of the Dublin and Lucan Tramway, said that he had examined the trolley and the equipment of the car in question, and found all in proper working order.

In his summing up, Mr. Justice Dodd said the Tramway Co. could not be held responsible if they could not have reasonably anticipated the accident, and their witnesses said they had never known such a thing to have happened in their experience. Even if the car was going fast it did not constitute negligence, unless the driver could reasonably have anticipated that the speed of the car would have resulted in the trolley falling.

Hodges *v.* Webb.

(The Electrical Trades Union Dispute.)

Mr. Justice Peterson, on Friday, February 20th, in the Chancery Division, delivered a reserved judgment in the case heard in the previous month in which Mr. Sidney Dumas Hodges sought an injunction to restrain the defendant, Mr. William John Webb, the London secretary of the Electrical Trades Union, or his agents, from interfering or attempting to interfere with his employment, and the right to dispose of his labour as he willed.

Mr. Hughes, K.C., and Mr. H. G. Purchase appeared for the plaintiff, and Mr. Cunliffe, K.C., with Mr. R. H. Hodge represented the defendant.

The plaintiff is a member of the National Association of Supervising Electricians, and was engaged in October last in the capacity of foreman electrician on a contract at Delectaland, Watford. His case against the defendant was that because he would not join the Electrical Trades Union, the workmen were called out on strike, in consequence of which his employers, in order that they might carry out their contract, had to discharge him. On behalf of Mr. Hodges, it

was contended that the defendant had tried to coerce the plaintiff to abandon his membership of the N.A.S.E., and join the other union, that he had conducted a malicious vendetta against plaintiff, and that the case came within the decision of Valentine and Hyde bearing upon the same points.

The defendant's case was that he was entitled to do what he had done under the Trade Disputes Act, as his action was entirely the outcome of a trade dispute, and much evidence was taken to prove that a dispute did actually exist at the time when the defendant did that of which the plaintiff complained.

Mr. Justice Peterson, in the course of his judgment, which occupied over an hour in delivery, said that the National Association of Supervising Electricians, which was formed in 1914, was at first in the main an educational institution, and under its rules its members were prohibited from taking part in trade disputes. In 1918, however, it was registered as a trade union, but it failed to obtain recognition by the Trade Union Congress, and it was apparent that the Electrical Trades Union considered there was ground for believing that the N.A.S.E. was under the influence of, and had the sympathy of, the employers. Under these circumstances the E.T.U., rightly or wrongly, objected to its members working with members of the N.A.S.E. The E.T.U. at the beginning of 1919 had withdrawn all its members employed by a firm because the firm employed members of the N.A.S.E., and the strike remained still unsettled. It was, said his lordship, an acute and burning question between the employers and the workmen in the industry. The London section of the National Federated Electrical Association—the employers' federation—had passed a resolution declining to yield to the policy of the E.T.U. He was of opinion that the defendant did ask the plaintiff to join the E.T.U. When he, plaintiff, refused to do so, he said he would call the men off the job, and that they would not return until he was dismissed. His lordship said he did not believe the allegation that the defendant had made use of a threatening gesture, and he was satisfied that the only effective reason for calling out the men was the refusal of the plaintiff to join the E.T.U. He did not think it would be fair to draw the inference that the men were withdrawn from their work because the defendant was annoyed at the observations made by the plaintiff.

It was the sole duty of a judge, in a case of this kind, to consider whether a complaint was lawful or unlawful. After the passing of the Trade Disputes Act in 1908 it was impossible to argue that if an authorised trade union official called out the members of his union in furtherance of a trade dispute, he was liable to be sued merely on the ground that he interfered with the business of the employer or the employment of any person. In his view, there was a trade dispute in this case, and whether the trade union was right or not appeared to be immaterial. There was a trade dispute between the employers and the workmen, and he was unable to hold that defendant had used such coercion against Messrs. Tyler & Freeman, the employers, as to render him liable in damages to the plaintiff. Coercion was a word of ambiguous import. The pressure used in this case was not coercion which constituted ground for action. If it were, there would be few strikes in which employers or workmen, or both, could not say that they had been coerced. The question was whether the defendant had employed unlawful means, and that question was not to be solved by saying that defendant's words amounted to a threat. No legal exception could be taken to a strike, and it was not an illegal act to intimate that under certain circumstances a strike would take place. It could not be unlawful pressure to protest, after due intimation, and say that a strike would take place. He was not prepared to hold that defendant could be made liable in damages to the plaintiff for saying that he intended to do that which he was by law entitled to do. It might be called a threat by some people, but whether it was a threat or a warning, it was in fact a statement that defendant would adopt lawful means for the purpose of giving effect to the union's lawful policy. The conclusion at which he had arrived, his lordship said, was that the defendant endeavoured to persuade plaintiff to become a member of the Electrical Trades Union, and that while doing so he pointed out that if he (plaintiff) persisted in his refusal to do so he would inevitably be exposed to difficulties in the future. He did not think that after making the observation in question the defendant used threats towards the plaintiff. He did not consider the question whether, if it was a threat, defendant was liable to be sued for threatening to give effect to the policy of the union in a trade dispute between employers and the union. In his view that was a question of fact which it was not necessary to answer. The action, therefore failed, and would be dismissed with costs.

Judgment was accordingly entered for the defendant with costs.

Breach of the Factory Acts.

At Sunderland Police Court on Friday, Messrs. Wm. Gray & Co., Ltd. (the Wear Shipyard), Pallion, were summoned in respect of five alleged breaches of the Factory Act. Mr. W. B. Lauder, for the prosecution, said the case was brought because of defendants' neglect to observe electricity regulations on December 16th, with the result that a youth named Robert Allan Black was killed. By the regulations an authorised person to supervise the undertaking of certain repairs to an electric cable used for supplying light to a ship in course of construction had to be over 21 years of age. Black was only 16 years of age, and he had an assistant only 17. A mishap occurred, and through some means while Black was coupling two electric wires he was killed by shock. Defendants, who said they had no knowledge of what was being done and did not consent to or connive at it, were fined £5. Convictions were recorded without penalty on two other counts alleging that inadequate precautions had been taken.

TRANSFORMERS FOR ELECTRIC FURNACES.

At Newcastle-upon-Tyne, on February 9th, Mr. J. L. Thompson's paper on the above subject, an abstract of which appeared in our issue of January 30th, was read and discussed before the North-Eastern Centre of the Institution of Electrical Engineers.

Mr. V. Stobie thought it was the first time that the subject had been dealt with publicly. He had not known any breakdowns due to tappings, the troubles they had had were on the H.T. side, and due to radial, rather than axial stress. The corner windings broke down sometimes, due to abrasion consequent upon movement inside the transformer; insulation gave way there more quickly than elsewhere. That the stresses were low was hardly the point; it was not the magnitude of the stress, but its repetition that caused the abrasion of the insulation. As to the passage of oil through the ventilating ducts, he knew one case where a transformer had broken down from want of ventilation, and in that case the builders, in order to get greater reactance, had put in some special iron between the windings, and to do so had cut down the size of the ventilating ducts. The interleaving of the L.T. conductors was another illustration of the fact that practice did not always follow theory. Regarding power factor, he mentioned a case where they had 7,500 amperes on one phase of the transformer, and another where they had 10,000 amperes per phase; on one furnace they got 0.93 power factor, without interleaving, and on the other they got 0.92. Referring to the author's suggestions to increase the voltage, the speaker said that personally he always used two electrodes. The practice was to reduce the voltage when the metal was molten, probably to 40 volts across the arc. Regarding the increase of the size of the furnace, he suggested, instead of one four-phase, two sets of two-phase, which saved complication for the steel people.

Mr. Taylor said that he had never had a breakdown on the tappings. In the diagram of the connections of the furnace transformer with the H.T. auto-regulating transformer and external reactance the choke coil was shown on the left hand. He suggested that it should be on the other side, so that it might lessen the switchgear needed. He had taken several power factor readings, and got 0.95 and 0.96, but over a period the average was 0.92.

Mr. Parrott remembered some years ago being called o see a plant where the transformer was blamed because the furnace would not melt; they could not get sufficient energy into the furnace. On examination of the lay-out, he found that they only got about 40 per cent. of the normal voltage that they should have had, and when that was altered, all went smoothly. He thought a suitable arrangement for large work would be to place the plant so that the transformer would be directly underneath the furnace; they could then bring up the leads through the floor, and so get the shortest possible length.

Mr. Clothier explained that years ago it was the practice to design transformer tanks with pockets into which the cables were brought through glands, so that there were no bare conductors exposed. He wished the author would include terminals arranged in that way. He thought that the question of the proper enclosure of conductors applied particularly to the comments made in the paper concerning the failure of tappings. A booster transformer, or an induction regulator for voltage variation, was introduced because the author found a difficulty in insulating his tappings. Surely the remedy was to improve the tappings, and not to foist this extra apparatus on the user. The remarks he had made about the enclosure of the conductors were, he admitted, difficult to apply to the L.T. side. There was no reference to failure of the switchgear; they were told that the troubles of the transformer had been overcome, he might tell them that the switchgear troubles also had been overcome.

Mr. Stigant, referring to the reinforcement of tappings, especially at the point where they were brought out, said his recent experience was that in certain directions manufacturers were inclined to take the view that when they were taken out at the centre it was not so necessary to reinforce them. He thought they should be as strongly reinforced at the centre, as at the end, because they were still likely to get high stresses and so damage the insulation. Numerous ventilation ducts should be avoided; it was far more important to provide a smaller number of ducts of a larger size so that they would get a substantial body of oil circulating through rather than have a larger number of ducts of a smaller size which were always liable to facilitate sludging.

Mr. Carr, Mr. Porter, and Mr. Davidson also took a brief part in the discussion, and Mr. Thompson replied.

NEW PATENTS APPLIED FOR 1920.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

3,866. "Word-counter and speed-tester for telegraph circuits." L. L. RAVENSCROFT. February 9th.

3,879. "Electric switches." J. A. CRABTREE. February 9th.

3,889. "Time-limit relays, circuit-breakers, &c." B. H. LEESON, J. MIRREY and A. REYROLLE & Co. February 9th.

3,891. "Electric rivet-heaters." R. F. WOODBURN. February 9th.

3,897. "Sparking plugs." A. SAUSER. February 9th.

3,906. "Sparking plugs and their relation to cycle of engine." A. BUCHANAN. February 9th.

3,914. "Protective arrangements for alternating-current electric circuits." R. A. R. BOLTON and SIEMENS BROS. DYNAMO WORKS. February 9th.

3,918. "Electric measuring or indicating instruments." BRITISH THOMSON-HOUSTON Co. and R. C. CLINKER. February 9th.

3,922. "Electrically-operated diaphragm horns." A. R. KEARNEY and B. A. QUINT. February 9th.

3,939. "Ignition magnetos for internal-combustion engines." FABRIQUES DES MONTRES ZENITH, SUCCESSEUR DE FABRIQUES DES MONTRES ZENITH G. FAVRE-JACOT ET CIE. February 9th. (Switzerland, April 15th, 1919.)

3,940. "Ignition magnetos for internal-combustion engines." FABRIQUES DES MONTRES ZENITH, SUCCESSEUR DE FABRIQUES DES MONTRES ZENITH G. FAVRE-JACOT ET CIE. February 9th. (Switzerland, June 11th, 1919.)

3,972. "Magneto-electric ignition apparatus for explosion engines." R. E. HEERD. February 9th. (Germany, May 30th, 1919.)

3,974. "High-tension magnetos for four-cylinder internal-combustion engines." SOC. PERFECTA. February 9th. (France, February 8th, 1919.)

3,979. "Portable electro-magnetic appliance for treatment of the hair." C. GRAHAM and P. E. MORGAN. February 9th.

3,987. "Electrical resistance apparatus." P. H. DAWE. February 9th.

4,003. "Carrier for electric lamp, &c., shades, reflectors, &c." A. P. RUTHERFORD. February 10th.

4,012. "Electric lamp." G. A. FENNIMORE. February 10th.

4,016. "Coupling dynamos, &c., to internal-combustion engines." S. L. BAILEY. February 10th.

4,049. "Electric incandescent lamps." L. B. CODD and C. MARTIN. February 10th.

4,058. "Electric heating apparatus." G. F. JOSEPH. February 10th.

4,078. "Electric lamps." A. KONIECZNY. February 10th.

4,085. "Electric switches." BRITISH THOMSON-HOUSTON Co. (General Electric Co., U.S.A.) February 10th.

4,102. "Testing sparking plugs." W. S. WOLFF. February 10th.

4,103. "Apparatus for testing lamps, fuses, sparking plugs, induction coils, &c." W. S. WOLFF. February 10th.

4,104. "Means for supply of electric current to railway, &c., tracks." W. T. JONES. February 10th.

4,117/8/9. "Negative plates for electric accumulators." A. POUCHAIN. February 10th.

4,120. "Negative plates for electric accumulators and manufacture of same." A. POUCHAIN. February 10th.

4,128. "Electric starters and cut-outs for electric lighting plants employing internal-combustion engines." C. C. GARRARD, A. H. RAILING and W. WILSON. February 11th.

4,144. "Combined electric switches and wall plugs and sockets." W. COMPSON, A. E. READ and WALSALL HARDWARE MANUFACTURING Co. February 11th.

4,172. "Trolley-pole heads for electric vehicles." E. FARRELL. February 11th.

4,185. "Arrangement for receiving submarine telegraphy, &c." M. D. DIMITRIEVITCH. February 11th.

4,204. "Electrical apparatus." BRITISH THOMSON-HOUSTON Co. (General Electric Co., U.S.A.) February 11th.

4,214. "Electrical apparatus for indicating and repeating movements at distances." J. L. ROUTIN. February 11th. (France, January 3rd.)

4,225. "Electrode holders for electric arc welding or cutting." C. B. WATERS. February 11th.

4,231. "Distributing devices for high-tension ignition machines." R. BOSCH AKT. GES. February 11th. (Germany, March 9th, 1918.)

4,239. "Measured service devices for telephone systems." AUTOMATIC TELEPHONE MANUFACTURING Co. (February 11th. (United States, February 12th, 1919.)

4,243. "Device for ascertaining direction of submarine sound waves." SIGNAL GES. February 11th. (Germany, November 20th, 1917.)

4,244. "Device for ascertaining direction of submarine sound waves." SIGNAL GES. February 11th. (Germany, June 5th, 1918.)

4,255. "Electric light attachment for rifles, &c." G. F. ROSARIO. February 11th.

4,260. "Electric switches." J. VAVER. February 11th. (France, March 20th, 1919.)

4,269. "Current-distributor for magneto-electric ignition apparatus." M. STROBEL. February 11th. (Germany, March 2nd, 1918.)

4,273. "Wireless telegraphy and telephony." H. MORRIS-AIREY, A. K. MACRORIE and G. SHEARING. February 11th.

4,274/5. "Transmitters for wireless telegraphy and telephony." A. K. MACRORIE and G. SHEARING. February 11th.

4,280. "Electrically producing gas for internal-combustion engines, &c." T. MCCLELLAND. February 12th.

4,292. "Electric overhead coke conveyers, &c." J. WIGLEY. February 12th.

4,293. "Machine for connecting tidal, &c., energy to mechanical and electrical energy." G. NEWMAN. February 12th.

4,306. "Electric switches." E. WATERHOUSE. February 12th.

4,311. "Mine-signalling systems." AUTOMATIC TELEPHONE MANUFACTURING Co. and H. L. SEARJEANT. February 12th.

4,314. "Sparking plugs." P. R. CARTWRIGHT and E. T. GLANVILLE. February 12th.

4,351. "Fittings for arc, &c., lamps." H. BERRY. February 12th.

4,377. "Portable electric lamps." COMPAGNIE GENERALE D'ELECTRICITE. February 12th. (France, May 27th, 1916.)

4,390. "Sparking plugs." J. L. PLATEL. February 12th. (France, September 28th, 1918.)

4,396. "Wireless telegraph receivers." L. B. TURNER. February 13th.

4,411. "Protective arrangements for electric distribution and transmission systems." CALLENDER'S CABLE & CONSTRUCTION Co. and P. V. HUNTER. February 13th.

4,417. "Trolley-wheel head and bearing socket of electric traction equipments, &c." J. K. MALONE. February 13th

4,426. "Electrical device for recording fires and burglaries and for gas, chemical and water protection." ELECTRICAL CONTRACTION Co. and R. D. ENGLAND. February 13th.

4,431. "Electrical conductors." ETNA LIGHTING & HEATING Co., G. HOOKHAM and H. R. PROSSER. February 13th.

4,454. "Wind power electricity-generating plant." P. BURNS and E. H. JONES. February 13th.

4,455. "Electric alarm for motor vehicles." L. W. APPLETON. February 13th.

4,463. "Protective devices for alternating-current systems." C. C. GARRARD, A. E. MCCOLE and A. H. RAILING. February 13th.

4,467. "Magnetic blow-out devices." T. ZWEIGBERGK. February 13th.

4,470. "Terminal connections for electric conductors." O. IMRAY (R. Bosch Akt. Ges.) February 13th.

4,471. "Releasing devices for armatures of electric-starting motors." R. BOSCH AKT. GES. February 13th. (Germany, February 20th, 1919.)

4,479. "Electrical illuminating apparatus for kinematograph projecting apparatus, &c." G. TEPPATI. February 13th. (Italy, August 27th, 1919.)

4,494. "Controlling devices for alternating-current dynamo-electric machines." BRITISH THOMSON-HOUSTON Co. and H. W. TAYLOR. February 13th.

4,495. "Vacuous electric-discharge devices." BRITISH THOMSON-HOUSTON Co. and J. GRAY. February 13th.

4,501. "Automatic telephone systems." AUTOMATIC TELEPHONE MANUFACTURING Co. February 13th. (United States, May 31st, 1919.)

4,521. "Automatic attachment for turning off electric switches, gas taps, &c." F. C. ENDECOTT. February 14th.

4,523. "Electrical apparatus for heating air used in machines for drying, cleansing or carbonising wool, cotton, &c." E. JENKINS. February 14th.

4,526. "Electric pianos." J. I. HALL. February 14th.

4,529. "Cooling tanks for electrical transformers, &c." E. J. JENKINS. February 14th.

4,531. "Single-phase transformer." L. GUISEPPE. February 14th.

4,544. "Carrier for electric lamp shades, reflectors, &c." A. P. RUTHERFORD. February 14th.

4,546. "Sparking plugs." H. S. COOKE. February 14th.

4,570. "Magnetic deflectors for electric arcs in lamps, searchlights, &c." H. C. GIBSON and J. P. YORKE. February 14th.

4,577. "Incandescent electric lamps, &c." J. T. CALLOWAY. February 14th.

4,583. "Crystal detectors of electric currents." H. M. DOWSETT. February 14th.

4,592. "Flame-proof boxes for switches, fuses, &c." W. T. HENLEY'S TELEGRAPH WORKS Co. February 14th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1918.

5,918. ELECTRICAL MEASURING APPARATUS. Siemens & Halske Akt. Ges. March 27th, 1917. (114,632.)

7,006. COINFREED TELEPHONE CALL-BOXES. Ges. fur Elektrische Industrie. May 25th, 1914. (115,241.)

7,011. COINFREED TELEPHONE CALL-BOXES. Ges. fur Elektrische Industrie. March 19th, 1917. (Addition to 115,241.) (115,242.)

18,208. ROTATING MAGNETS OF MAGNETO-ELECTRIC IGNITION APPARATUS. Scintilla. November 6th, 1917. (120,902.)

18,626. ELECTRIC VALVE AMPLIFIERS. G. F. Partridge and B. S. Smith. November 13th, 1918. (137,876.)

20,170. AUTOMATIC TELEPHONE SYSTEMS. D. S. Hulfish. December 8th, 1917. (121,471.)

1919.

1,976. ELECTRIC LAMPS OR LANTERNS. J. Y. Fletcher and F. W. Ball. January 27th, 1919. (137,914.)

3,641. ELECTRIC COUPLINGS. W. C. Lea. February 14th, 1919. (137,932.)

4,299. MAGNETIC DEFLECTORS FOR ELECTRIC ARCS IN LAMPS, SEARCHLIGHTS, AND THE LIKE. J. P. Yorke. February 20th, 1919. (137,937.)

7,294. AUTOMATIC COIN-OPERATED TELEPHONE CALLING APPARATUS. T. M. Fletcher. March 24th, 1919. (137,958.)

8,478. SPARKING PLUGS. G. H. Barraclough. April 4th, 1919. (137,967.)

13,028. CONTROL MEANS FOR ELECTRO-MAGNETIC RECIPROCATING DEVICES. Igranic Electric Co. (Cutler-Hammer Manufacturing Co.) May 23rd, 1919. (138,001.)

13,664. MAGNETOS. B. Ames. May 29th, 1919. (138,007.)

13,920. SPARKING PLUGS. H. R. Wilks. June 2nd, 1919. (138,008.)

16,431. SPARKING PLUG FOR INTERNAL-COMBUSTION ENGINES. L. Febbraro. June 30th, 1919. (138,023.)

18,325. STORAGE BATTERY LOCOMOTIVE. Mancha Storage Battery Locomotive Co. August 31st, 1918. (132,233.)

18,933. METHODS OF INDIRECTLY COUPLING A RADIO-TELEGRAPHIC ANTENNA TO A HIGH-FREQUENCY ALTERNATOR. J. Bethenod. July 30th, 1918. (130,614.)

20,149. INSULATING CAPS FOR ELECTRICAL JOINTS. M. Ritsema. September 18th, 1918. (132,779.)

20,313. SPARKING PLUGS FOR EXPLOSION MOTORS. R. Breton. June 4th, 1919. (138,037.)

21,040. ELECTRIC KETTLES AND THE LIKE. A. S. Ford. August 27th, 1919. (138,039.)

21,855. ELECTRIC REACTANCE COILS OR TRANSFORMERS. Electrical Improvements, Ltd., and J. R. Beard. September 5th, 1919. (Addition to 133,135.) (138,043.)

24,121. ELECTRIC IGNITION APPARATUS. American Bosch Magneto Corporatoin. October 1st, 1918. (133,318.)

26,166. MEANS FOR COOLING DYNAMO-ELECTRIC MACHINES. E. F. W. Alexanderson. November 26th, 1918. (135,825.)

A Dutch Ericsson Telephone Works.—The firm of Koopman & Co., of Amsterdam, announce that, with the co-operation of the Almänna Telefon A.B. L.M. Ericsson, of Stockholm, they have formed a group who have taken over the shares in the Electrische Werktuigen Fabriek, of Rijen, near Breda. It is proposed to convert the latter into the Nederlandsche Ericsson Telefoon Fabrieken, with a share capital of 3,000,000 florins (pre-war, £250,000). In order to possess a sales organisation for Holland and the Dutch colonies, an agreement has been entered into with Koopman & Co., who have for years past imported telephone plant from Sweden, and who since 1916 have taken over the connections of the Netherlands Bell Telephone Co., in so far as these were not transferred to the Dutch Government.